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BY

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The Journal of Obstetrics and Gynæcology of the British Empire

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Contribution to the Study of the Early Human Ovum

based upon the investigation of

I. A very early Ovum embedded in the Uterus

and

II. A very early Ovum embedded in the Infundibulum of the Tube.

By R. W. JOHNSTONE, M.A., M.D., F.R.C.S.E.

Assistant to the Professor of Midwifery in the University of Edinburgh; Extern Assistant Physician, Royal Maternity Hospital; Obstetric Physician, New Town Dispensary; Gynæcologist, Livingstone Dispensary.

OUR knowledge of the development of the human ovum during the first weeks of its life is still so incomplete that it becomes a duty to place on record the main features of any such specimen that may be met with. From the nature of things these specimens must be rare, and the majority of them will probably always continue to be obtained in early abortions. Although the great possible value of such cases is evidenced by the flood of light that the Bryce-Teacher ovum has thrown on the subject, and by such a record as Jung's, still any specimen obtained *in situ* must of necessity approach more nearly to the normal. I consider myself peculiarly fortunate, therefore, in having obtained within ten months two specimens of an early ovum *in situ*. Moreover the fact that one is embedded in the uterus and the other in the tube affords an interesting contrast and comparison of the earliest stages of development in the normal and abnormal situations.

The first specimen is that of an ovum of about fifteen days embedded in the uterus. Its general features do not differ in any great degree from the classical description of Hubert Peters. The embryonic structures are, however, very difficult to interpret, and

one perfectly legitimate view of them is that the specimen is one of uniovular twins in a very early stage of development. If such be the case, the specimen is absolutely unique.

The second specimen is an infundibular tubal pregnancy of about twenty days duration. So far as I have been able to ascertain, this specimen is also unique, all the other records of the very early stages of tubal implantation being based upon ampullar or isthmic pregnancies. In addition to this the case has one other feature of great importance etiologically, namely that it affords a perfect demonstration of the fact that the ovum must have come from the opposite ovary and migrated round the back of the uterus to reach the site of its implantation.

I have thought it well to divide this paper into two parts. In the first place I have recorded the history and minute anatomical features of both specimens. In doing so I have tried to state what I saw, without reading into the statement my own opinion as to the nature of the appearances. The second part of the paper is a discussion of the different features, in which I have ventured to state my own views as to the specimens, and have compared their most interesting features with some of the other early ova on record.

Terminology.

For the sake of brevity and to avoid misconception, it may be as well to state shortly the sense in which I shall employ certain terms. The terms used to denote the topographical and histological divisions of the decidua, such as *basalis, capsularis, vera, compacta* and *spongiosa,* require no explanation. The terms *equatorial* and *polar* applied to the decidua capsularis are explained in the text. Some confusion, however, exists in regard to the meaning of such words as *syncytium, trophoblast, trophoderm* and the like.

The word *trophoblast* was applied by Hubrecht to the chorionic or extra-embryonic ectoderm. But strictly speaking it applies to it only when that structure remains in passive relationship to the surrounding tissues. Whenever it proliferates and assumes histolytic functions it ceases to be in line with Hubrecht's definition, and for this proliferative histolytic 'trophoblast' Minot has suggested the term *trophoderm*. In man, unlike many other mammalia, this layer is always actively proliferative, and accordingly the term *trophoderm* is the more correct one to use in human development. I agree with Herzog that etymologically either term is a misnomer. It suggests that the layer is wholly connected with the nutrition of the embryo. But as Herzog points out, the trophoderm is thousands of times greater in mass than the embryo, and this seems too extravagant a provision for nutrition alone. Indeed we have clear evidence that nutrition is only a minor func-

tion of this layer in the early stages, and its most important action is to enable the ovum to form stable attachments for itself to the maternal tissues. This it does by proliferating freely, and, in all probability, secreting a proteolytic ferment which destroys and digests the maternal tissues with which it comes into contact.

The term *syncytium* has been so long applied to the outer layer of the trophoderm as to be wedded to it. Etymologically it also is a misnomer, as the word connotes a tissue which is formed by the running together of cells. That this is the real mode of its formation we have no clear evidence; indeed there is as much reason to believe that it arises from the very beginning as a plasmodial layer. The term *plasmoditrophoderm* would be more correct on this latter understanding. Since, however, we have no proof on either side, and since the word *syncytium* is so constantly used in the literature, I have preferred to retain it. As will be explained in the text the term *symplasma* is used to denote a clearly degenerative coalescence of cells, or a degeneration of the syncytium.

First Specimen.

On March 16, 1913, a married woman, aged twenty-nine, died suddenly in this city. She had previously complained of no symptoms beyond a shortness of breath on exertion, and a tendency to faintness. She had had three children, the youngest a year old. The husband did not know the actual date of the last menstruation, but he was certain that she had not missed a menstrual period, and neither of them had had the slightest idea that she was pregnant.

A post mortem examination was ordered, and in the course of it the uterus was noticed to be somewhat enlarged. It was accordingly removed for further examination. The pathologist's notes on the case are briefly as follows:—The heart was in a state of advanced fatty degeneration. The stomach was congested and empty. The liver, spleen, kidneys, and lungs were normal. The uterus was slightly enlarged, and soft. The tubes were engorged with blood. The right ovary was swollen and congested. The cause of death was, therefore, the sudden failure of the heart, owing to advanced myocardial degeneration.

Unfortunately the autopsy was not made until nearly forty-eight hours after death, and the uterus was thereafter kept in Kaiserling's fluid for eighteen hours. It was then opened, but still other twelve hours elapsed before it was seen by Professor Harvey Littlejohn. He at once realised the possible significance of its contents, and sent it over to Dr. Barbour at the University Gynæcological Laboratory. In the absence on holiday of Dr. Barbour I began the investigation, and he has very kindly allowed me to continue and complete it.

The uterus was slightly enlarged, and the endometrium very distinctly thickened and thrown into irregular elevations and furrows. On the posterior wall of the cavity, a little above the centre, there was a small dark crimson object, protruding like a wart from the surface. It measured 4·5 mm. vertically, and 5 mm. from side to side. Its base was slightly narrowed, so that it overhung a little at its lower edge. In appearance it suggested a pedunculated wart, or a subepithelial hæmatoma, although the surrounding mucosa was not unduly congested. (1).*

A portion of the endometrium on the opposite side of the cavity was removed and embedded in paraffin. On section it showed the characteristic appearances of a decidua. The projection with its immediately surrounding decidua was thereupon removed, right down to the muscle wall of the uterus: and after I had obtained the advice and guidance of Professor Arthur Robinson on the specimen, it was dehydrated and embedded in paraffin. The entire block was then cut into 679 serial sections, each section being 10 microns thick. The plane of section was vertical to the surface of the decidua, and in the long axis of the uterus. The sections were stained with hæmatoxylin and eosin.

The projection was found to contain a young ovum surrounded with early villi, lying in an implantation cavity partly filled with maternal blood, and bounded on all sides by decidua. (3 & 4).

Examination of the sections revealed the fact that the specimen had unfortunately received considerable damage—probably due to the uterus being firmly grasped antero-posteriorly during its removal from the body. There is thus a rent in the decidua capsularis, which has also extended into the wall of the blastocyst or chorionic vesicle. The latter contains some maternal blood, showing that the damage had been received before the fixation of the specimen. Apart from this the specimen is in a wonderfully good state of preservation considering the circumstances in which it was obtained. The histological appearances are not to any extent obscured.

Dimensions of the Ovum.

Owing to the fact that it is ruptured, it is impossible to give absolutely exact measurements of the implantation cavity. But as the amount of displacement caused by the rupture is comparatively slight in most places, a closely approximate estimate may legitimately be made. In length from above downwards the implantation cavity measures (in section **21.1.1**) 3·67 mm., and in depth from before backwards 2·46 mm. It runs through 468 sections, each 10 microns thick, and therefore measures in breadth 4·68 mm.

Owing to the damage received by the specimen, much the same qualifications have to be made with regard to the measurements of the blastocyst as applied to the implantation cavity. The blasto-

*The numbers in brackets refer to the illustrations.

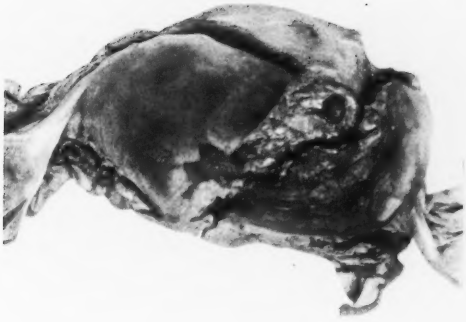

FIG. 1.—Uterus opened, showing ovum *in situ*.

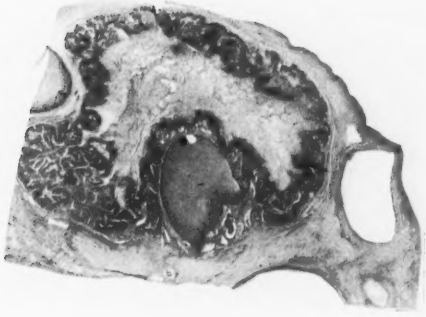

FIG. 2 —Corpus luteum.

cyst, however, is not so much torn as the decidua capsularis, and accordingly a still more accurate approximation to exactitude can be made in regard to it. Exclusive of the thickness of the wall, and of the outgrowing villi, the blastocyst runs through 272 sections, each 10 microns thick, and therefore measures 2,720 microns or 2·72 mm. from side to side. This is its greatest internal dimension. In section 22.1.5, which is the largest section of the blastocyst in which it is complete and untorn, the other two dimensions are respectively 1·66 and 0·84 mm. As this section is almost exactly through the middle of the blastocyst, it may be taken as giving the maximum dimensions with almost perfect accuracy.

On comparing it with the other youngest complete human ova, it is found to approximate fairly closely to that of Jung:—

Bryce-Teacher, 0·77 × 0·63 × 0·52.
*Linzenmeier, 0·75 × 0·615 × 0·525.
Peters, 1·6 × 0·8 × 0·9.
Fetzer, 1·6 × 0·9.
v. Spee, 1·5 × 2·5.
Herzog, 2·32 × 0·8 × 1·2.
Heine-Hofbauer, 2·38 × 0·98 × 1·2.
Jung, 2·5 × 2·2 × 1·0.
Johnstone, 2·72 × 1·66 × 0·84.

Decidua Vera.

The condition of the decidua vera was studied in the sections of a portion removed from the anterior wall of the cavity—as far as possible from the site of the ovum. It measured 6·5 mm. in thickness. It presents in a characteristic way the appearance of two layers—the superficial compact and the spongy. It is crammed with decidual cells, which are most easily observed in the compact layer, although present in the trabeculæ between the glands of the

*Unfortunately, this paper was in the press before Linzenmeier's description of Stoeckel's ovum was published. The ovum was shown at the Gyn. Congress at Munich in 1911. It was obtained, perfectly fresh, *in situ* in a uterus removed for repeated hæmorrhages one month after curettage. The ovum is, therefore, less than a month old. The uterus was almost certainly pathological. In its stage of development the ovum would appear to lie between the Bryce-Teacher ovum and Peters' ovum. The embryo consists of an amnion and yolk sac, the former measuring 0·105 × 0·09 mm., the latter half these figures. There is a definite embryonic disc measuring 0·21 × 0.105 × 0·02 mm. The embryonic anlagen are contained in a loose mass of mesoderm continuous with that lining the blastocyst, a distinct advance from the stage in the Bryce-Teacher ovum. The mesoderm is just beginning to form cores to the villi. The intervillous space is filled with blood, fresh and apparently in recent circulation. The two layers of trophoderm are well defined, but towards the periphery of the trophodermic shell seem to merge into each other indiscriminately. The implantation cavity is closed by a closing coagulum, lenticular in shape, consisting of partially organised blood and fibrin and trophoderm cells. The endometrium shows no true decidual cells, but is in a state of premenstrual congestion and œdema. The basal blood spaces are partly capillaries and partly blood-filled glands. The surface epithelium was intact except over the closing coagulum. The illustrations are disappointing.

spongy layer. No mitotic figures have been observed in the decidual cells, but this may well be due in part to the length of time that elapsed between the death of the patient and the fixation of the specimen, as well as to the somewhat crude fixative used.

The surface epithelium is almost completely wanting. Here and there in the depressions around the mouths of glands a few columnar cells are to be seen in series, and here and there a few isolated cells are to be found sticking up aslant like the last remnants of a derelict palisade. Probably this is due to maceration for a similar condition prevails in the glands themselves. In them the epithelial cells are for the most part desquamated and lying loose in the lumina—the whole decidua having a catarrhal appearance. Indeed the gland spaces are so much filled up with epithelial debris that the differentiation into the spongy and compact layers is slightly obscured at a first glance.

The blood vessels of the decidua vera are not unduly dilated. Here and there the veins are enlarged, but there is no great congestion, although the whole membrane is distinctly œdematous. Scattered throughout, but most marked in the proximity of the venules, there is a slight infiltration with round cells that look like lymphocytes.

Decidua Basalis.

The ovum is embedded in the superficial compact layer, and therefore lies upon a cushion of spongiosa and the deepest part of the compacta. This latter is, however, hardly recognizable as such owing to the presence of large blood spaces. The differentiation into the layers is not very obvious in the basalis, owing to these blood spaces, and to the catarrhal condition of the glands.

Decidual cells are to be seen in large clumps or islands in the compacta near the border zone. Elsewhere they are almost completely absent, and broadly speaking they are not so marked a feature of the basalis as of the decidua vera.

Immediately posterior to the ovum there are a great many large blood spaces crammed with maternal blood corpuscles. (4). In most cases these spaces may be recognized as distended capillaries or venules, either by tracing vessels into them and observing their sudden widening out, or by the recognition of the flat endothelial lining. In some cases where this recognition is impossible the spaces may be true interstitial spaces. In the border zone indeed the whole stroma is infiltrated with blood. In one or two cases the presence of numerous degenerated epithelial cells in the blood suggests that the space was originally a gland space.

In the deeper portions of the decidua the congestion is less marked, and the normal corkscrew vessels are recognizable.

Throughout the entire decidua basalis, but most marked in the

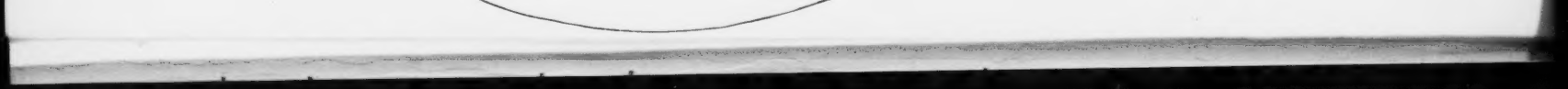

FIG. 3.—Section showing blastocyst and intervillous space.

B—Mesoderm of blastocyst shrunk away from epithelium in many places.
Bl—Blastocyst.
BS—Blood space.
CE—Chorionic epithelium.
DB—Decidua basalis.
DC—Decidua capsularis.
E—Embryonic vesicle with attachment to chorionic mesoderm.
IS—Intervillous space.

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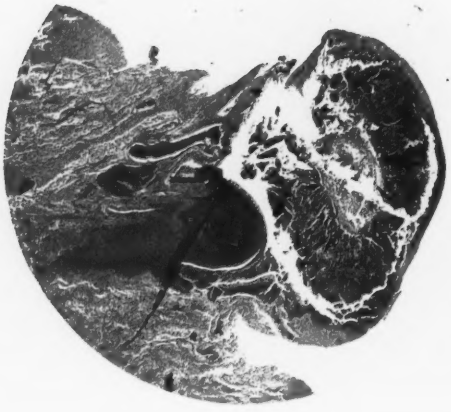

FIG. 4.—Complete section of ovum and surrounding decidua, showing blood spaces opening into intervillous space.

BS—Blood spaces in decidua basalis.
DB—Decidua basalis.
DC—Decidua capsularis.
IS—Intervillous space.
M—Blastocyst wall (ruptured).
O—Blood spaces opening directly into intervillous space.

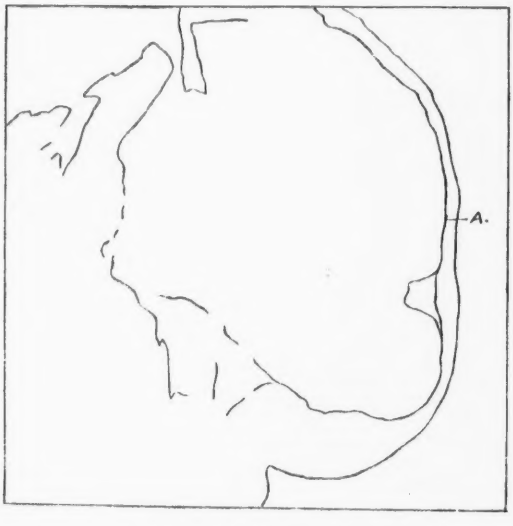

FIG. 5.—At A in the decidua capsularis gland tissue is present (*see* Fig. 6).

FIG. 4.—Complete section of ovum and surrounding decidua, showing blood spaces opening into intervillous space.

BS—Blood spaces in decidua basalis.
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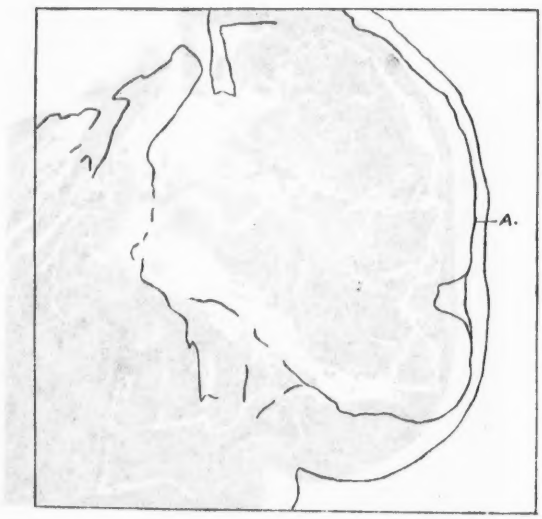


FIG. 5.—At A in the decidua capsularis gland tissue is present (*see* Fig. 6).

neighbourhood of the ovum, there is a definite leucocytic infiltration, in many cases considerable clumps of lymphocytes being seen in the proximity of a vessel.

The glands are very numerous and very dilated. The catarrhal condition of the epithelium has been referred to already. Towards the surface the glands appear to be pushed to the sides to make room for the blood spaces. They diverge and run up on either side into the capsularis, becoming more or less parallel to its surface.

Decidua Capsularis.

One of the most noticeable features about the present specimen, and one which is obvious to the naked eye, is the marked extent to which the embedded ovum projects above the surface of the surrounding decidua. At the first glance it looked like a wart, and on closer examination like a pedunculated wart. This is borne out by the examination of the sections. The projection containing the ovum has a relatively narrow base, which it overhangs at the lower edge. (4).

It is convenient for purposes of description to follow Pfannenstiel in dividing the decidua capsularis into two divisions—the *equatorial* and the *polar*. By the equatorial portions are meant those parts which form a ring around the ovum and are directly and immediately continuous with the decidua basalis. By the polar region is meant that part which covers the summit of the embedded ovum, and is farthest removed from the basalis.

In thickness the decidua capsularis gradually diminishes as we follow it from the equatorial to the polar region. Over the latter its average thickness is about 0·1 mm., while in the equatorial regions it attains as much as three times that thickness.

In the equatorial regions it consists of very much the same structures as the basalis—that is to say, of œdematous endometrial stroma infiltrated with blood, and containing many distended vessels full of blood. As has already been mentioned, the glands of the basalis are pushed aside by the wedge-shaped area of large distended blood spaces, and they run up into the capsularis for a short distance parallel to the surface. Disconnected portions of glandular tissue are, however, recognizable in the capsularis at a point very near the polar region. (5 & 6). I have not been able to recognize any gland opening into the implantation cavity.

The stroma of the capsularis does not contain any large decidual cells, but it is invaded particularly on its inner aspect and in the neighbourhood of the attachment of the cell-columns by trophodermic cells. The polar decidua consists very largely of fibrinoid material with a thin film of cells over its outer aspect. This fibrin is not altogether wanting on the inner aspect of the equatorial parts,

but it becomes distinctly more prominent over the summit of the ovum. It is infiltrated on its inner side by trophodermic cells, and in one or two places little masses of syncytium have penetrated almost through its entire thickness. One or two of these syncytial masses actually have the striated border, the nature of which will be discussed later.

The Border Zone.

As has just been indicated, the border zone on its capsular aspect—or in other words the inner edge of the capsularis—consists of endometrial stroma infiltrated with trophodermic cells. Here and there a layer of fibrin is noticeable, particularly over the polar region, but this is neither universal nor continuous. In many places the cells of the capsularis are very chaotically disarranged, as if the tissue had been torn up by œdema, and many of them are more or less degenerated. There are numerous small spaces filled with blood, and in many cases these open directly into the implantation cavity.

The basal aspect of the implantation cavity is made up largely of the thin walls of the distended blood spaces. These walls are in some cases little thicker than films, composed of tissue which has undergone a fibrinoid degeneration and is invaded freely by trophodermic cells and plasmodium. In many areas this invasion has led to a loosening of the structure which has permitted the escape of blood into the implantation cavity. (**22.1.3.**) In short the implantation cavity is lined indiscriminately by invading trophodermic cells and plasmodium, by fibrinoid, and by more or less necrotic decidual stroma.

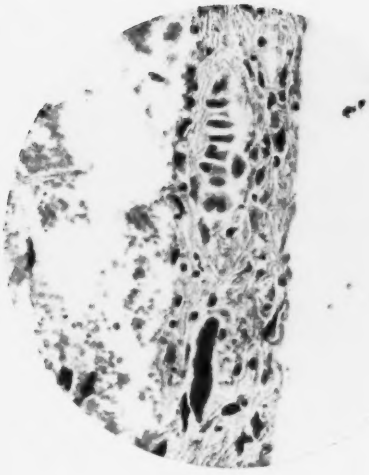
In at least two instances a distended blood vessel may be seen opening directly into the implantation cavity. (**4**). In one place the wall of a blood space appears to have degenerated. The cells have lost their outline and the nuclei are swollen, elongated and pale. The protoplasm contains brownish granules. Thus the tissue exactly corresponds in appearance and staining reactions to the syncytium of the outer part of the intervillous space. (**7**).

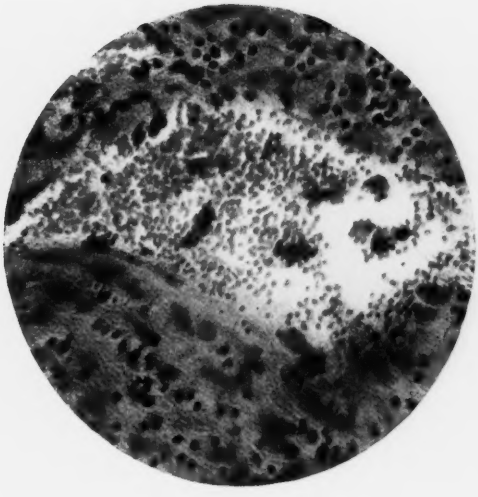
The Chorionic Villi and the Intervillous Space.

All round the circumference of the chorionic vesicle villous processes are observed growing out towards the surface of the decidua. These villi are, practically speaking, equally numerous and equally long all round the chorion—that is to say, there is not yet any increased exuberance of growth towards the decidua basalis, such as occurs later. The chorio-decidual space or intervillous space is full of maternal blood, which penetrates into all the interstices between the villi.

FIG. 6.—Decidua capsularis, showing remains of a gland. Below it is an elongated darkly stained mass of syncytium.

FIG. 7.—Section of small blood space in decidua basalis, showing degeneration of its wall into "symplasma maternum conjunctivum."





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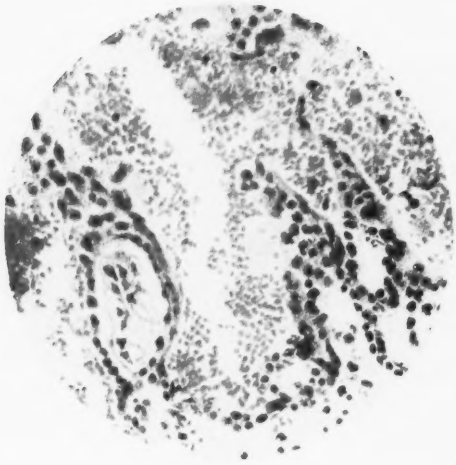

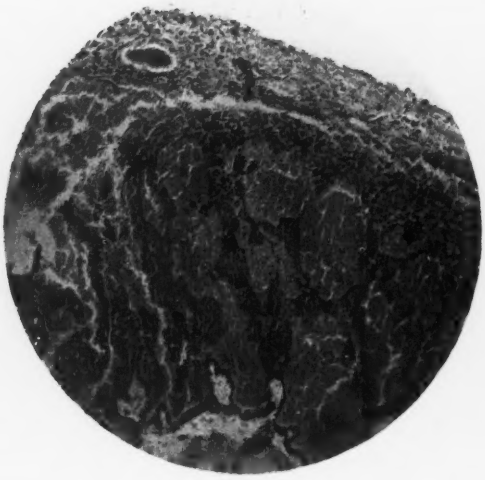

FIG. 8.—Portion of chorionic membrane with outgrowing villi.

C—Mesodermic core of villus shrunk away from epithelium.
CH—Chorion.
T—Trophodermic cell column.
W—Space left by shrinkage of core.

FIG. 9.—Showing attachment of trophodermic cell columns to decidua.

CC—Cell columns.
DC—Decidua capsularis.
V—Villus.
M—Mesoderm of chorion.

FIG. 8.—Portion of chorionic membrane with outgrowing villi.

C—Mesodermic core of villus shrunk away from epithelium.
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T—Trophodermic cell column.
W—Space left by shrinkage of core.

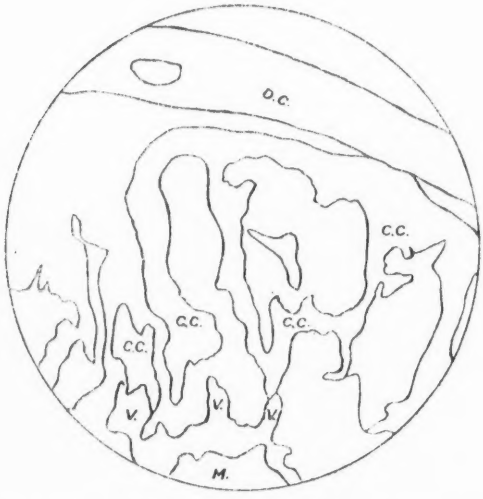


FIG. 9.—Showing attachment of trophodermic cell columns to decidua.

CC—Cell columns.
DC—Decidua capsularis.
V—Villus.
M—Mesoderm of chorion.

The proximal portions of all the villi are hollowed out by a mesodermic core. In many places this core has, unfortunately, been withdrawn inwards from its epithelial covering by the shrinkage of the mesoderm during fixation. Where it has thus been separated from its covering it presents a very smoothly defined edge, not at all unlike an endothelium. There is no appearance of embryonic capillaries in the villi. In addition to the core the villi have a double covering of trophodermic epithelium—an inner layer of cytotrophoderm and an outer layer of plasmoditrophoderm. (8).

The cytotrophoderm—Langhan's layer—is present mostly as a single layer over the surface of the chorionic membrane and the greater part of the villi. But towards the tips of the villi it becomes heaped together into large columns or masses. These unite with each other by irregular lateral outgrowths, and spread themselves outwards to the surface of the implantation cavity in a shapeless and chaotic network. At the decidual surface they become attached by the trophoderm cells spreading laterally over the face of the decidua and also invading it. (9). The cells of the cytotrophoderm are rounded or oval, and contain rather deeply staining round nuclei which fill up the greater part of the cell.

The plasmoditrophoderm—the syncytium—is very irregular in its distribution. In some places it is absent over the surface of the chorionic membrane; in others it forms an almost unrecognizably thin layer; while in yet other parts it is very obvious as masses or buds, or as slender strands spreading over the surface of the cell columns, and stretching between them. (10). Farther out towards the decidua it is mostly found in such solid clumps or strands. On the surface of the chorionic membrane the syncytium where present has long, thin, flattened nuclei, diffusely stained. In the more uniform strands stretched over the cell columns and villi these oblong flat nuclei are still visible. But in the strands and clumps towards the periphery of the intervillous space the nuclei are more often larger, and rounded or oval in shape, vesicular, and faintly stained. Frequently these last nuclei are shrunken and crenated, and ghostly in appearance. The protoplasm of the syncytium is throughout foamlike and in many parts vacuolated. Everywhere this layer presents the appearance of tiny brownish granules, which are refractile, scattered through the protoplasm, and particularly numerous in the perinuclear protoplasm. Sometimes these granules are so numerous as to give a strand of syncytium the appearance of a brown streak along the middle of it.

In the outer part of the intervillous space there are numerous large free cells, some with large pale nuclei, others with numerous small dark nuclei. The former can usually be traced by serial sections to the strands with the large degenerate nuclei referred to

above. The latter can also usually be traced to syncytial buds, the nuclei on cross section appearing smaller and round. Some of these wandering cells appear to be quite detached. In one or two instances the syncytium of these giant cells shows faint indications of a striated border.

There is a certain amount of vacuolation in the cell columns, empty spaces appearing, devoid of blood or any other content but a little structureless matter. These spaces are not due to the withdrawal of the mesodermic core from the villi, as they occur far beyond the utmost limits of the mesoderm in the substance of the cytotrophoderm columns. Serial sections do not show them to communicate with the intervillous space. (11).

The Chorionic Membrane.

The epithelium has already been described in connection with the villi. Both epithelial layers stain deeply with hæmatoxylin and eosin, giving the ovum a dark outline even under low magnification.

The mesoderm of the chorion constitutes a fairly uniform layer of about 0·05 mm. in thickness. It consists of a delicate connective tissue with elongated spindle-shaped cells having round or oval nuclei arranged mostly parallel to the surface. The inner portion is less nucleated and gradually becomes continuous with a structureless debris inside the vesicle. This debris or 'magma' does not fill up the entire vesicle, but is quite irregular in its distribution. The outer edge of the mesoderm where it is shrunk away from the epithelium has a smooth appearance not unlike an endothelium.

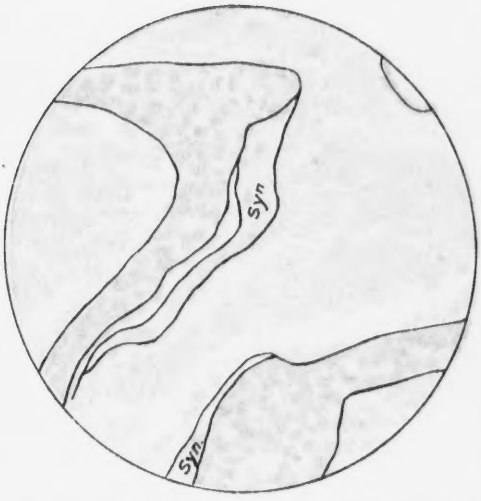
Embryonic Anlagen.

Owing to the damage received by the specimen the embryonic rudiments are considerably folded and at one or two points broken. It is therefore impossible to identify them with absolute certainty, and I shall in the first place merely describe what is to be seen.

As one follows through the sections one comes first upon a vesicle which is somewhat crumpled, but is roughly triangular in shape. (12 & 14). This vesicle passes through 35 sections and therefore measures in this direction 0·35 mm. Its other maximum diameters are 0·39 and 0·21 mm. In most parts it presents two definite layers of cells. The outer layer, which is sometimes very much thinned, contains cells with oval nuclei. In the thinned parts these are flattened out and arranged parallel to the surface. This layer corresponds in every way to the mesodermic lining of the chorion, and with this tissue it is at one angle of the triangle definitely and substantially continuous. The inner layer is composed of rather larger cells which stain more deeply, and contain large round or oval nuclei with well marked, deeply staining chromatin network.

FIG. 10.—Trophodermic cell columns, with strands of syncytium (syn.).

FIG. 11.—Portions of trophodermic cell columns with empty spaces (A) which do not communicate with the intervillous space.



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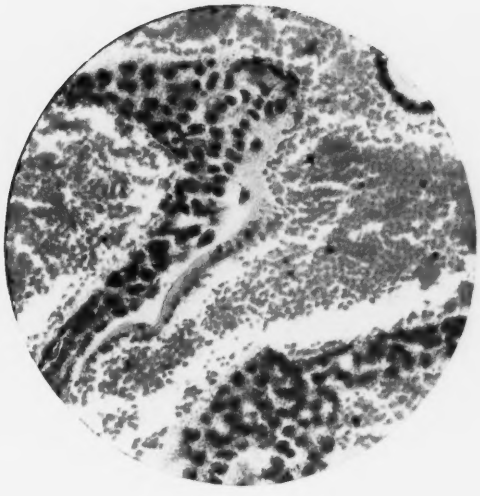
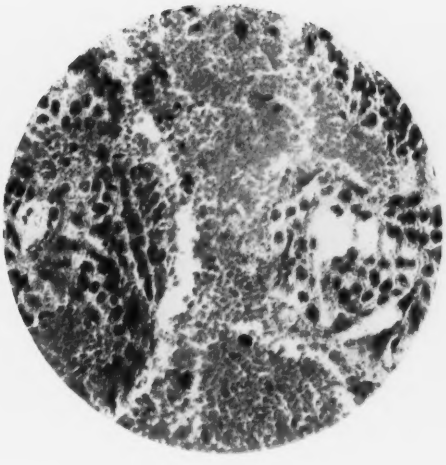




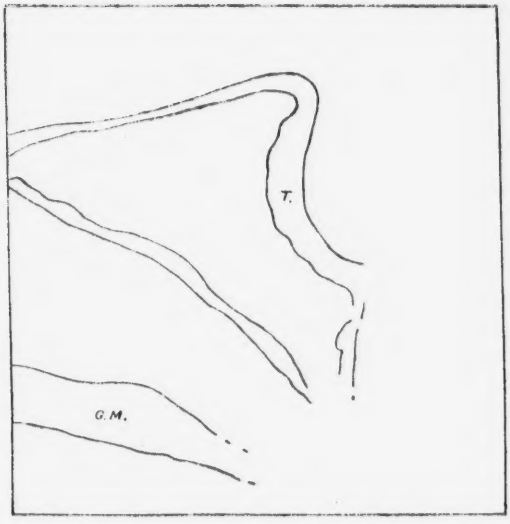


FIG. 12.—First vesicle of embryo.

CM—Chorionic mesoderm.
T—Thickening which *may* represent an embryonic area.

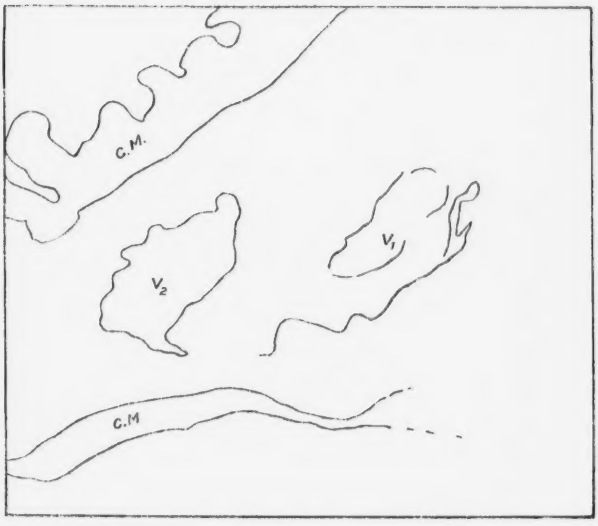
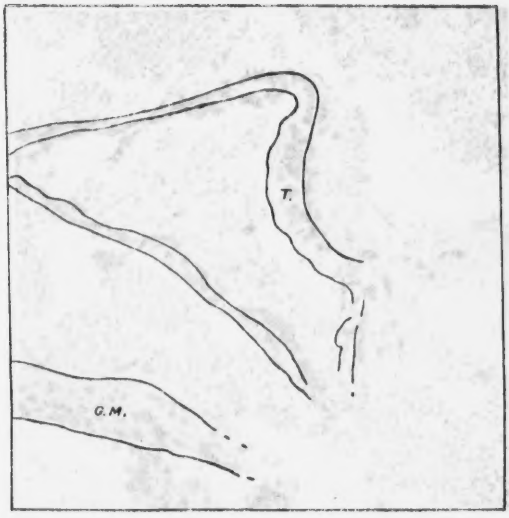


FIG. 13.—Both embryonic vesicles.

CM—Mesoderm of chorion. | V_1—First vesicle.
V_2—Second vesicle.



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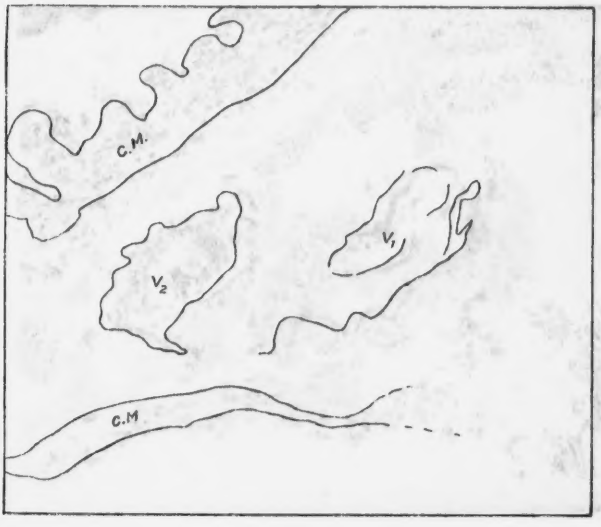

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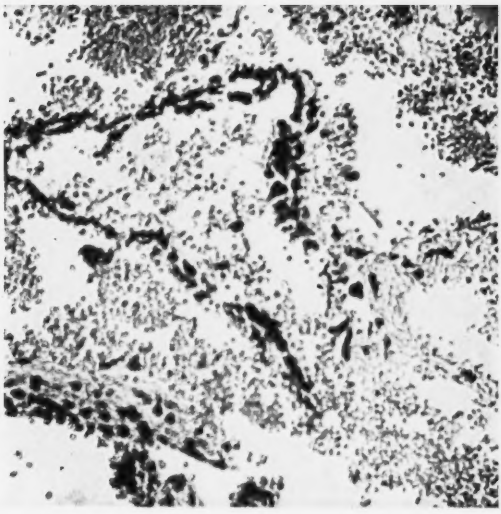

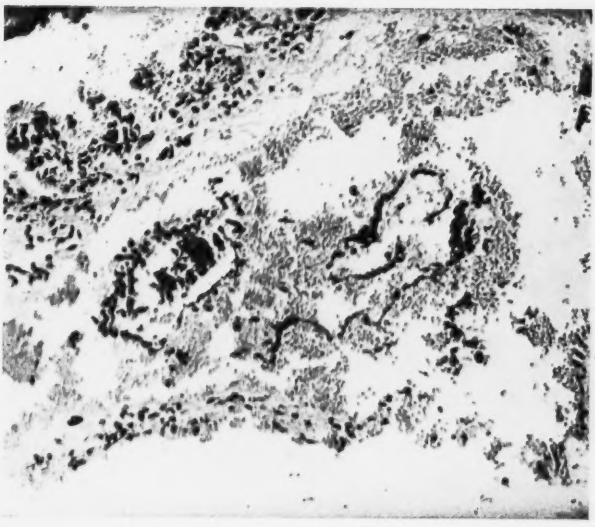

FIG. 14. First vesicle and its attachment to the mesoderm of the blastocyst wall.

FIG. 15. First vesicle with pocket at lower right corner.
B. Blastocyst wall.

FIG. 16. Portion of blastocyst with both vesicles.—Compare Fig. 13.

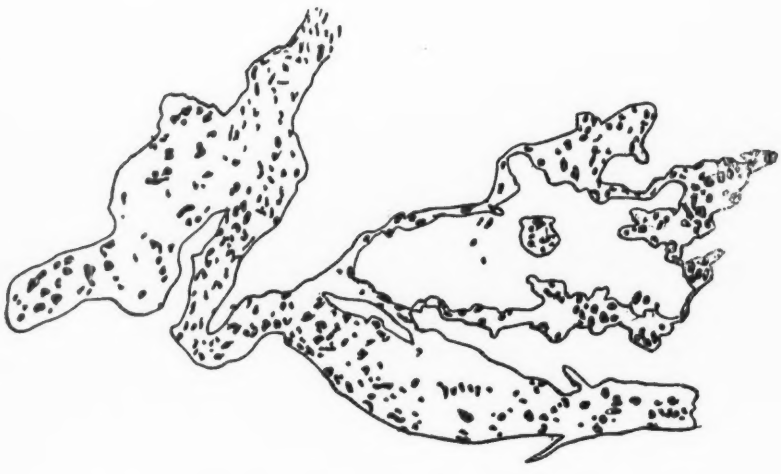

FIG. 17. Showing attachment of second vesicle to blastocyst wall.

The shortest side of this triangular vesicle presents an appearance very like an embryonic area—that is to say, it is composed of cells heaped together in three or more irregular rows. In this area, which measures 0·21 by 0·2 mm., the nuclei are more oval, and tend to be arranged perpendicularly to the edge of the vesicle.

At one end of this 'area' a considerable fold or pocket is given off, which, but for serial sectioning, might easily have been mistaken for a second smaller vesicle. It is, however, directly continuous with the larger portion of the vesicle. (15).

FIG. 18. Portion of blastocyst with both vesicles, showing the flooring of cells in the second vesicle.

On the wall of the larger portion there are one or two thickenings which resemble the anlagen of blood vessels. But on tracing these through several sections they are found to be merely localised thickenings, which it is impossible to denote definitely as the precursors of vessels. This vesicle is unfortunately ruptured at one end, and there are a few maternal red blood corpuscles present within it, as well as some of the mesodermic magma.

In the later sections containing this first vesicle a second vesicle makes its appearance to the left of the first. (13, 16, 18). This passes through 26 sections and accordingly measures in this direction 0·26 mm.

Its other maximum diameters measure 0·28 and 0·14 mm. It is also somewhat crumpled, and is roughly triangular in shape. In structure it is a replica of the first, presenting the same two layers of cells. At the angle farthest away from the first vesicle it also is definitely and substantially attached to the blastocyst wall, its outer layer being for some distance continuous with the mesodermal lining of the chorion. (17).

In a number of the sections about one-third of the way through this vesicle, the cavity of the vesicle is almost wholly filled up with cells. (13 & 18). This flooring of cells appears to divide it more or less completely into two smaller vesicles. This vesicle, like the first, is not absolutely intact, and several red blood corpuscles may be seen in its interior. At no point do the two vesicles come into actual contact, and their attachments to the wall of the blastocyst are towards the opposite extremes of the one side of that structure.

The Corpus Luteum. (2).

Exact measurements of the corpus luteum have not been made, but the figure shows a section through it as nearly as may be through the middle. This section measures 1·3 by 1 centimetre. The normal shape is encroached upon by a small follicular cyst. The centre of the corpus luteum is occupied by a mass of pale finely granular material like mucus, stained pink with eosin. In it are several clumps and strings of red and white corpuscles. At the margins it becomes continuous with masses of red blood cells which fill up all the bays between the infoldings of the lutein layer. This layer is of varying depth but never less than eight or ten cells deep. It appears crenated owing to the papillary ingrowths, each of which has a stout 'core' of young and extremely vascular connective tissue. These connective tissue ingrowths appear to be branching in parts and pushing the lutein layer before them. There is a great deal of vacuolation amongst the lutein cells, some considerably large spaces being formed. The cells are polygonal or star-shaped, and their terminal fibrils stretch across these spaces. The nuclei are about twice the size of a red blood corpuscle and stain well. The whole layer is very vascular, many capillaries being recognizable, and there is also a good deal of blood lying free in the stroma. At parts this blood is clearly continuous with that in the centre of the corpus luteum.

Second Specimen.

The second specimen I owe to the kindness of Dr. William Fordyce. It was obtained from a private patient of his upon whom I assisted him to operate. She had a retroverted uterus, and an enlarged tender ovary on the left side. The abdomen was opened in order to perform a Gilliam's operation, and to deal with the

FIG. 19.—Section through tubal ovum.

B—Blastocyst (chorion).
BS—Blood spaces in fimbriæ.
CM—Capsular membrane.
F—Fimbriæ of tube.
IS—Intervillous space, with sections of villi.
T—Mass of trophodermic cells.
YS—Yolk sac (ruptured).

FIG. 20.—Capsular membrane, with trophodermic cells applied to the inner (right) surface.

FIG. 19.—Section through tubal ovum.

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FIG. 20.—Capsular membrane, with trophodermic cells applied to the inner (right) surface.

ovary if necessary. The left ovary was found to be slightly cystic, and to our surprise there was a blood clot about the size of a large hazel nut protruding from the fimbriated end of the left tube. (30). The opposite ovary presented a recent corpus luteum on the surface. The left tube and ovary were removed, and the round ligaments shortened.

There was nothing in the patient's history to suggest, before the operation, the likelihood of a pregnancy, tubal or otherwise.

The tube and ovary were at once placed in Pick's No. 1 solution and fixed. In the belief that the specimen was one of a tubal abortion, and that probably the ovum was broken up, I opened the blood clot after three days, with the intention of making a museum preparation. Somewhat to my surprise I found it to contain an apparently complete chorionic vesicle, although no trace of an embryo was to be seen by the naked eye. The vesicle seemed to be entirely surrounded by blood clot, but was entangled in or attached to the fimbriæ anteriorly and below. I then cut away the infundibular end of the tube with the blood clot, and had serial sections made of the entire clot. The sections were cut 7 microns thick, and the plane of section vertical and parallel to the long axis of the tube—this being the plane of my first incision. The sections thus pass from the back to the front of the specimen. In all some six hundred sections were cut. Most of them were stained with hæmatoxylin and eosin, but some with Mallory's, some with van Gieson's, and some with Weigert's stains.

Study of the sections revealed an intact chorionic vesicle, containing an early embryo, superficially embedded in the fimbriæ on the antero-inferior margin of the tube. The embryo is somewhat damaged, probably owing to the inevitable handling of the specimen during its removal, and partly to the unfortunate opening of the specimen before it was cut. (19).

The rest of the tube showed no traces, either macroscopic or microscopic, of having been the seat of a gestation, or of any other abnormality.

Dimensions of the Ovum.

The chorionic vesicle, exclusive of its villi, runs through about 390 sections. Owing to the fact that the specimen was opened with a razor before the sections were made, some small portion of the thickness appears to have been lost—not more than the thickness of one or two sections. But a close approximation would give its measure in this diameter as 2·73 mm. In one of the middle sections (**52.1.1.**) its other diameters measure 6 and 5·6 mm. respectively. The whole vesicle is therefore of a flattened, almost circular shape. The flattening is in the diameter at right angles to the attachment to the fimbriæ of the tube, and in this way it corres-

ponds to the lenticular shape of young ova embedded in the uterine decidua.

The embryo, including the two vesicles, is cut very obliquely, and runs through 306 sections. It therefore measures 2·1mm. in this direction. The embryonic area proper runs through 230 sections, and thus measures 1·6 mm.

Attachments of the Ovum.

On the lower and anterior aspects the blood clot was seen to be attached to the fimbriæ of the tube. Microscopic section shows that there is a definite organic attachment, thus indicating that the implantation was in all probability originally an infundibular one, and that we are not dealing with a tubal abortion, as at first I was led to suppose. The portions of the fimbriæ which come into the sections are seen to be covered, on those aspects not in contact with the ovum, with intact columnar epithelium, ciliated in many parts. On the one side, however, the epithelium is absent, the ovum being definitely but superficially attached to it.

On this latter aspect there is a shallow saucer-shaped depression, to the surface of which the ovum has attached itself, and which represents, therefore, the implantation cavity. At the edges of this "basalis" area, if we may so call it, there has evidently been an attempt at the formation of a ' capsular membrane,' and some of the elements of the tube wall can be seen stretching a short distance round the ovum. Nowhere does the stroma of the fimbriæ show any real decidual reaction in the shape of decidual cells, but there is in parts some enlargement of both muscle and connective tissue cells.

The whole stroma, moreover, is in a most chaotic state of disarrangement. It appears to have been torn up by œdema, the cells lying at some distance from each other, and many of the cells are distinctly degenerated. The blood vessels of the fimbriæ are enormously distended and full of blood. Several of them form large blood spaces which are separated from the intervillous space only by a very thin wall. The stroma is in many parts densely infiltrated with red blood corpuscles.

The capsular membrane consists of stroma elements only for a very short distance on each side. For the most part these elements are strongly reinforced by fibrinoid material, which forms the sole covering over more than half the surface of the ovum. (20).

Border Zone.

In relation to the capsular membrane just described there is little to correspond to the border zone of a normal implantation beyond the presence of the fibrinoid material and the occasional

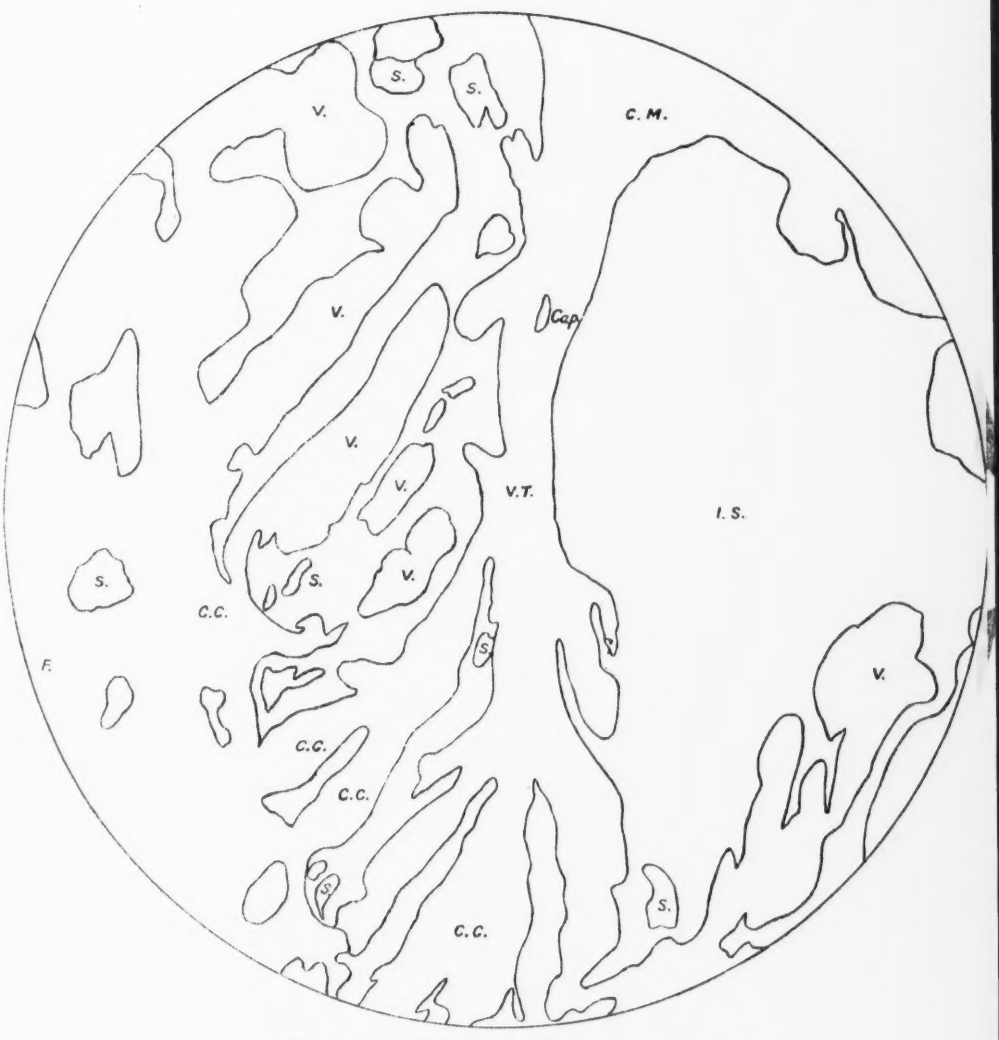

FIG. 21.—**Chorionic villus of twenty days' ovum.**

Cap—Capillary being formed in mesoderm.
CC—Trophodermic cell columns.
S—Syncytium.
V—Villus branch.
VT—Villus trunk.
CM—Chorionic membrane.
F—Fimbria.
IS—Intervillous space.

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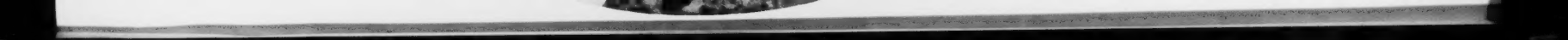

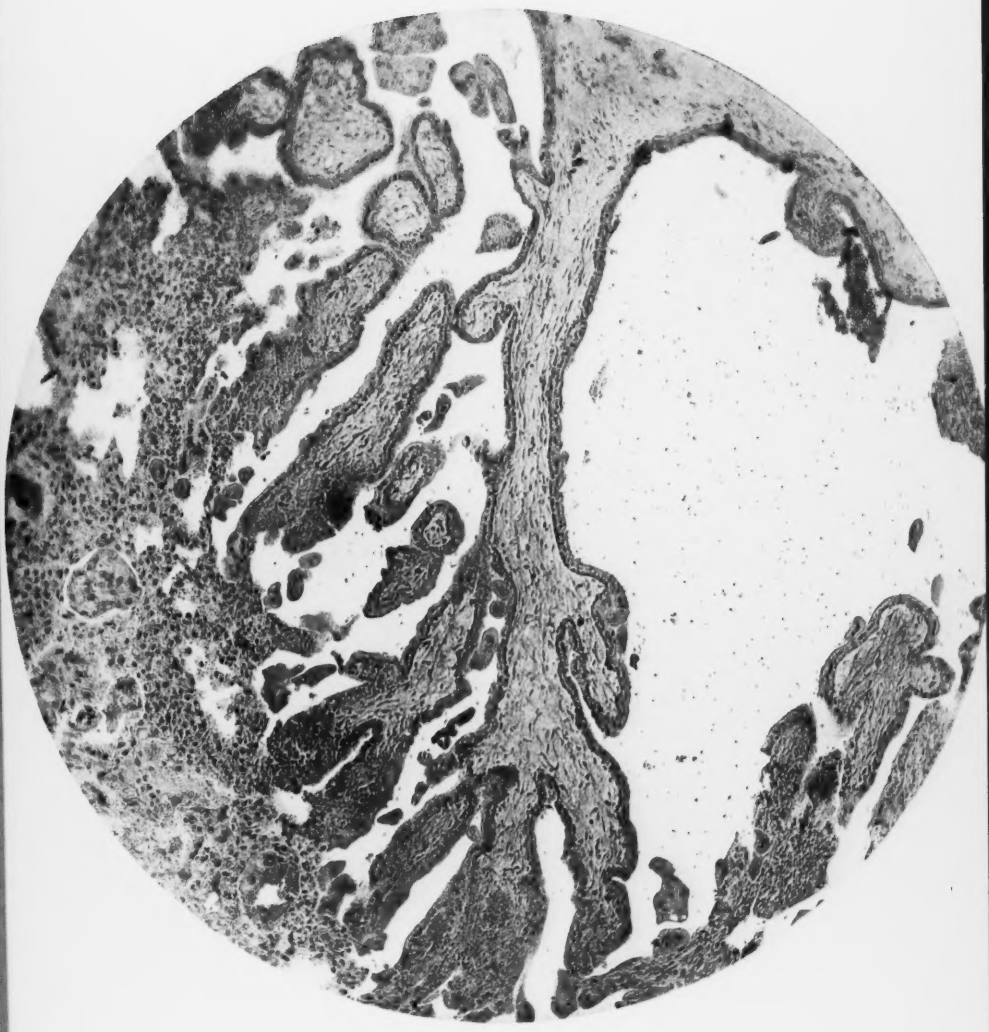

invasion of it by trophodermic islands, either cellular or syncytial. In the 'basalis' area, however, in which there is maternal tissue present, the changes are closely similar to those in an intra-uterine implantation. Mention has already been made of the enlargement of some of the muscular and connective tissue cells, as well as of the dilatation of the blood vessels and the formation of blood spaces. In addition to this there is a very obvious invasion of the trophodermic elements into the tubal wall, both cells and syncytial masses being found at some little distance from the surface. There is also presumable evidence of the destructive action of the trophoderm in the presence of fibrinoid or semi-fibrinoid degenerated layers.

The Intervillous Space and the Chorionic Vesicle.

The intervillous space is not full of blood except in some portions. But throughout there is clear evidence of its having contained blood in the presence of occasional blood islands, of red blood corpuscles adherent to the epithelium of the villi, and in the blood which fills many of the smallest interstices. The villi are distinctly more numerous, more luxuriant, and more than twice as long on the side of the chorionic vesicle apposed to the fimbriæ of the tube. On the fimbrial aspect one villus measures 1·75mm. in length, while on the opposite side of the blastocyst the average length does not exceed 0·75 mm. In other words there is here a commencement of the differentiation of the chorion frondosum and the chorion laeve.

In the chorion frondosum the villi are normal in their structure. I have been fortunate in getting one typical villus in longitudinal section through almost its whole length. (21). In this area also there is a great development and multiplication of trophodermic cells. These form large cell columns which branch outwards from the ends of the shorter villi, and, uniting with each other, form a chaotic network. Where they reach the surface of the tube wall or the capsular membrane they spread out laterally, and to a marked extent invade these structures. This appearance is much more marked on the fimbrial aspect of the ovum than on the capsular. On the latter many of the short villi end abruptly with no outgrowth of trophoderm. There are numerous spaces in these cell columns, some containing blood, others empty. Some of the empty spaces cannot be traced to the periphery of the columns, and are therefore enclosed spaces exactly similar to those described in the early intra-uterine ovum. Covering these cell masses there are strands and masses of plasmoditrophoderm or syncytium, to which reference will be made later.

The blastocyst consists of a layer of mesoderm covered by two layers of epithelium. All three layers are continued into the villi.

The inner layer of trophoderm epithelium is Langhans' layer, and consists of a very regular single row of cells with rounded or oval nuclei which fill up the greater part of the cells and stain deeply. It is noticeable that where these cells pass into the cell columns at the ends of the villi, as just described, they become distinctly enlarged.

In the chorionic membrane and the villi the syncytium is spread as a thin covering of fairly uniform thickness over the Langhans' layer. The protoplasm has a finely foamy appearance. The nuclei are mostly small and oval with a well marked chromatin network, and deeply stained nucleoli. A few of the nuclei are larger and pale, but I have not observed any so ghostly in appearance as many seen in the earlier intra-uterine specimen. In some of the more tangential sections Langhans' cells appear in two or three layers, as also the nuclei of the syncytium. I believe, however, that this is largely due to the obliquity of the sections.

In the intervillous space syncytium is present, as mentioned, in the form of strands and masses on the outside, and not infrequently in the inside, of the trophoderm cell columns. In several places there are islets of multinucleated syncytium lying free. Some of these may be traced by serial sections to buds of the villous coverings; others cannot, and appear to be absolutely free.

An interesting point about the syncytium in this specimen is that in many portions—in practically all the buds and islands just described and in quite a number of the villi—it presents a distinct cuticle which has a striated appearance.

Inside the trophoderm the blastocyst is lined with a layer of delicate mesoderm, varying in thickness. This passes out into the villi forming their cores. Strangely enough the structure of this mesoderm is more definite in the villus cores than in the portion lining the chorionic membrane. In one or two of the cores capillary vessels may be seen in the process of formation. In none of them was any blood observed.

The structure of the mesoderm is similar to that of the earlier specimen. The nuclei are more or less oval, and towards the outside are arranged parallel to the surface. Internally it fades irregularly into a structureless magma which is present here and there within the vesicle. At the corner of the vesicle corresponding to the greatest development of the villi, the mesoderm reticulum is rather greater in quantity, and here is to be found the embryo.

The Embryo.

The yolk sac has been ruptured, and part of its wall displaced outward. Including this displaced portion the whole embryo runs through 306 sections and therefore measures 2·142 mm. Exclusive of this, the embryonic structures are present in 230 sections, which

FIG. 22.—Embryo—hind sections.

A—Amniotic cavity. | C—Chorion.
BS—Belly stalk. | G—Gut.
M—Medullary groove.

FIG. 23.—Allantois (All.) just visible, passing from hind gut into the belly stalk.

Fig. 22.—Embryo—hind sections.

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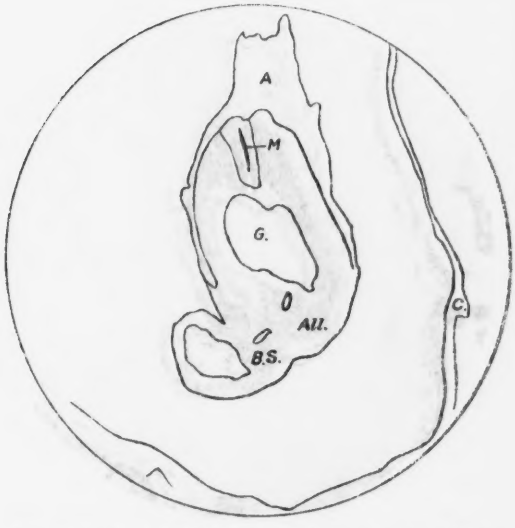


Fig. 23.—Allantois (All.) just visible, passing from hind gut into the belly stalk.

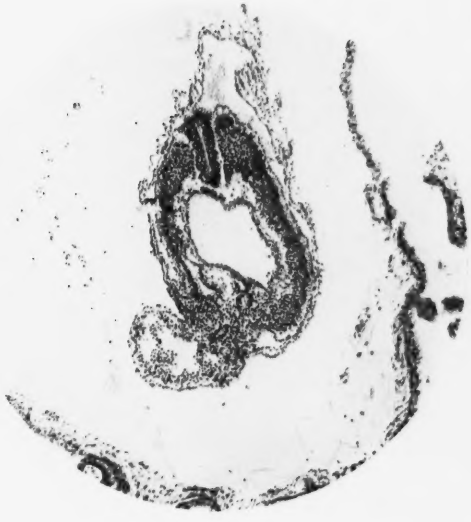


Fig. 24.

A – Amniotic cavity. | C – Chorion.
All – Allantois. | G – Gut.
M – Medullary groove.

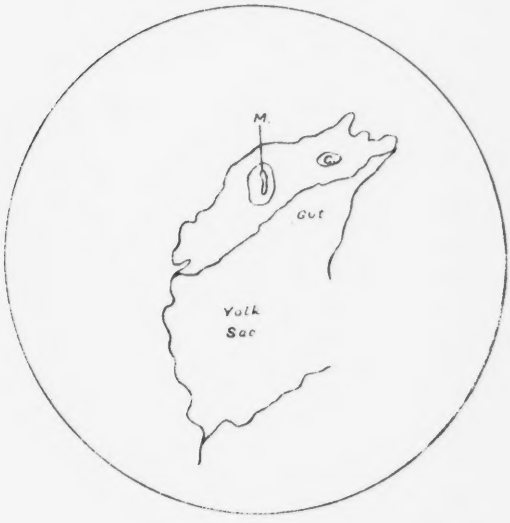


Fig. 25.

C—Cœlom. | M—Medullary groove.

Fig. 24.

A—Amniotic cavity. | C—Chorion.
All—Allantois. | G—Gut.
M—Medullary groove.

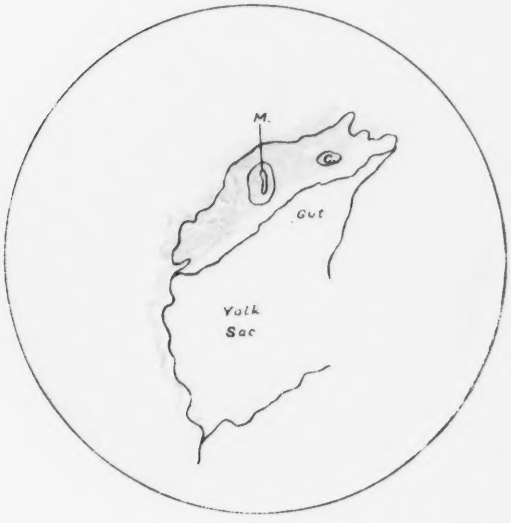
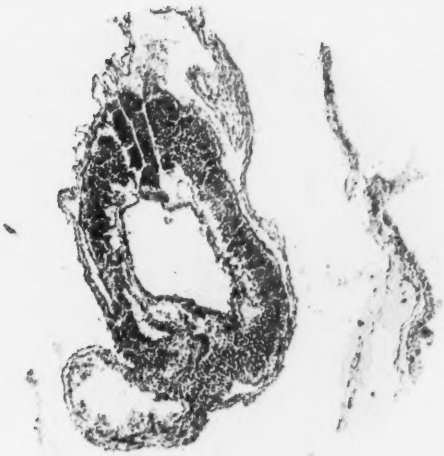


Fig. 25.

C—Cœlom. | M—Medullary groove.



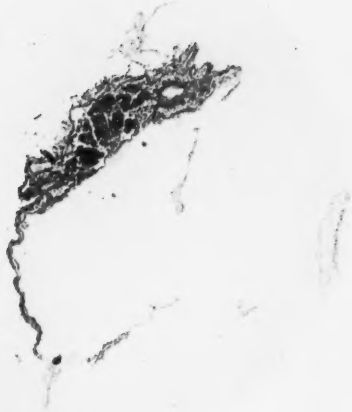


Fig. 26.

A—Amnion.
Coel.—Cœlom.
G—Gut.
H—Heart.
M—Medullary groove.
YS—Yolk sac, ruptured and opened out.

Fig. 27.—Syncytial mass, showing the striated border.

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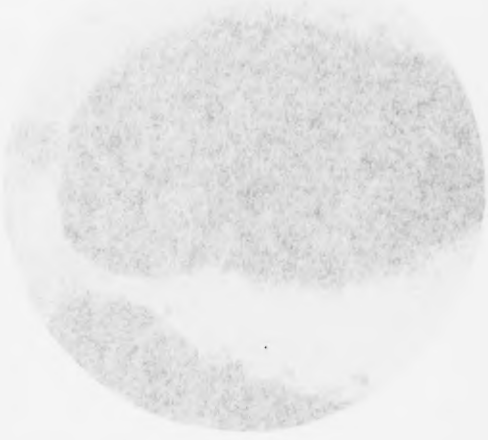
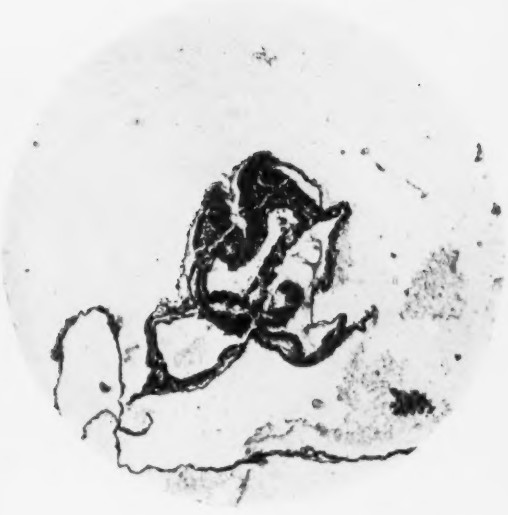


Fig. 27.—Syncytial mass, showing the striated border.



corresponds to 1·61 mm.—a more accurate measurement than the former. It has been cut very obliquely in a dorso-ventral plane. The hind portion is well seen, but more anteriorly the sections are not so satisfactory. In great part this is due to imperfect technique in mounting the sections, but the result has been to obscure some interesting appearances, and to render it difficult to be certain as to the absolute normality of the embryo. All that can be said is that those parts which can be well seen are normal.

In the earlier sections we find the caudal end of the embryo. The medullary groove, the notochord, the mesodermic somites, and the hind gut are all clearly visible. (22). Closely surrounding the whole is the amnion, consisting of two layers of cells. Posteriorly the hind gut dips down to the surface, from which it is separated by an anal plate or membrane. Below the embryo the amnion is attached to a mass of mesoderm—the belly stalk. This contains one large patent vessel with definite walls, and one or two small capillaries. The large vessel contains a number of red blood corpuscles, the great majority of which are definitely nucleated. In a small minority the nuclei have not taken on the stain satisfactorily. More anteriorly the gut becomes widened out, and the dip down to the anal plate disappears. (23 & 24). The belly stalk appears in direct continuity with the mesoderm of the body wall, the folds of the amnion coming down to the sides of the stalk. In the belly stalk the allantois may be distinguished as a slender column of epithelial cells running from the gut into the stalk. A little more anteriorly the gut is seen directly continuous with the widely opened yolk sac. The cœlom is just beginning to appear. The medullary groove is closed. (25).

At this point we come upon some unsatisfactory sections, but in more anterior sections we see the gut separated off from the yolk sac which is opened out widely and ruptured. (26). On each side the cœlom is visible, and projecting into the two halves are the anlagen of the heart. The amnion at this level is closely applied to the surface of the embryo. The yolk sac consists of two layers, much thinned out. At parts there are thickenings which seem to be the anlagen of vessels. The more anterior sections are, unfortunately, damaged.

Comparing these appearances with the data in the *Normentafeln* it is legitimate to conclude that the embryo comes in between the "Gle" embryo of v. Spee and the "Klb" embryo of Kroemer and Pfannenstiel.

DISCUSSION.

The Decidua.

The main features of the so-called 'decidual reaction' are the transformation of the embryonic connective tissue corpuscles of

the stroma—this origin can no longer be reasonably doubted—into the large decidual cells; the increase and distension of the glands, which become more tortuous in their course; the increased thickness of the endometrium, which becomes thrown into folds on the surface; and occasionally the congestion of the vessels and the œdematous nature of the stroma. What the stimulus is which gives rise to this profound change is unknown, as also the time of its occurrence—whether before or after the implantation of the ovum. Much speculation has been devoted to the question whether the stimulus may be due in some obscure bio-chemical fashion to the act of fertilisation, or to the influence of the corpus luteum, or to the actual invasion of the mucosa by the developing ovum. On none of these points have we any certain knowledge, but there are one or two facts from which probable conclusions may be drawn.

It is well known, for example, that analogous changes on a less marked scale take place in the endometrium during the premenstrual phase. It is also probable that a considerable number, if not the majority, of fertilised ova are embedded during that stage. Bryce and Teacher have argued strongly that the ovum *may* be embedded during any phase of the menstrual cycle, and this is in all likelihood the case. At the same time the premenstrual stage would appear to be the one in which most ova with a definite history were implanted.

In the second place it is noteworthy that in several of the recorded specimens of early ova the decidual reaction has been very imperfect. Thus the differentiation into the compact and spongy layers, which depends upon the increased growth of the glands, is present in Peters' case only in the immediate neighbourhood of the ovum, and in the older Heine-Hofbauer specimen it is wanting altogether. Again in both Peters' and Jung's ova there was no clear formation of decidual cells, but only a few enlarged cells in the vicinity of the ovum.

Furthermore we know that in the mouse, and more particularly in the guinea-pig, the endometrium undergoes no change whatever until the ovum has actually eaten its way through the surface epithelium.

Putting these facts together it seems not unfair to conclude that in all probability the decidual reaction proper does not occur until the ovum begins to invade the endometrium, and that the slight changes present in some recorded cases are merely the persistence of premenstrual conditions of varying intensity. The rapidity with which the reaction ensues may quite naturally vary in different cases.

It must not be forgotten that a strong argument against this provisional conclusion appears to rest in the formation of a uterine decidua in cases of extra-uterine pregnancy. But there is no

evidence, so far as I am aware, to indicate that the uterine change in such cases occurs before the ovum has embedded itself in its abnormal situation, and therefore we may legitimately conclude that the change is again due to some bio-chemical influence consequent upon the invasion of the ovum.

This argument practically assumes the truth of the view, first promulgated by Sir William Turner, that the decidual reaction is a protective one on the part of the maternal tissues. Everything points to the correctness of this view. There is, for example, the effort at decidual formation in the tube itself during pregnancy in that situation, as well as the appearance of decidual cells in the ovary, peritoneum, and cervix in some non-pregnant conditions. In all cases, moreover, the appearance of decidual cells is accompanied by a leucocytic infiltration, as has recently been pointed out by Meyer, and therefore it may be regarded as in some measure comparable to the ordinary reactions of inflammation. If the bio-chemical stimulus be blood-borne from the trophoderm, as seems most plausible, the uterine reaction in tubal pregnancy may easily be explained as a praiseworthy but misplaced effort on the part of the maternal tissues to counteract it.

At the same time the decidual reaction is in all probability indirectly but equally protective to the embryo, in that, by supporting and strengthening the maternal capillaries, it prevents a too sudden and too extensive opening up of these vessels—the probable consequence of which would be to tear up the delicate attachments of the ovum. The formation of a decidua is therefore to the mutual advantage of both mother and child.

My first specimen shows a very characteristic decidual reaction. The differentiation into the *compacta* and the *spongiosa* is well marked, although it is somewhat obscured by the free desquamation of the epithelial cells lining the glands. Decidual cells are found throughout in the compact layer, and to a lesser extent in the trabeculæ of the spongy part. I failed to find any mitotic figures in the cells, but this may be due to the circumstances in which the specimen was obtained. As a rule such changes are only to be seen in perfectly fresh and carefully fixed preparations. Marchand, Bonnet and others have recorded the presence of many. On the other hand, Herzog, whose specimen was obtained and prepared in an almost ideal manner, failed to detect any karyokinetic changes.

The comparative absence of the superficial epithelium in the present specimen is, I believe, largely due to maceration. It is absent in the Bryce-Teacher specimen, as might be expected after its adventures. It is wanting also to a great extent in Cova's ovum in spite of good preservation. In the great majority of other cases, however, it is present and in fairly good condition.

This maceration, which is evident also in the deeper parts of the glands in my ovum, makes it impossible to recognize the papillary projections of the epithelium into the lumina of the glands, which are by some regarded as a characteristic feature of the early decidua.

Apart from this maceration the glands seem to have suffered but little change even in the decidua basalis. They have obviously been pushed aside by the expansion of the ovum, the wedge-shaped space between them being occupied by the "cushion" of dilated blood spaces. Bryce and Teacher suggest that the glands are more resistant to the destructive action of the trophoderm than the other tissues, and this may well be so, although they ultimately suffer some dissolution. Frassi has shown conclusively that the glands may be opened into laterally, and it is probable that this may be effected either by the eroding action of trophodermic buds, or by the digestive action of the proteolytic ferments of the trophoderm, while that tissue itself is at some little distance.

This is presumably the explanation of three observed facts—firstly, the presence of epithelial "rests," in the "border zone," formerly but probably erroneously regarded as relics of the superficial epithelium; secondly, the opening of glands into the intervillous space as observed by Frassi and Fetzer—the glands as they run up towards the equatorial portion of the decidua capsularis being opened into laterally; and thirdly, as a consequence of this the presence of blood in the gland spaces, which has been noted by Siegenbeek van Heukelom, Leopold, and Fetzer amongst others.

These conditions I have not observed in the present specimen. The blood spaces nowhere have, unequivocally, the characters of glands, but for the most part appear to be dilated vessels. The flat endothelial lining can be seen in many places, while in others the identity can be established by tracing fully formed vessels into the spaces, and noticing how these vessels suddenly widen out into sinuses. Indeed they are absolutely comparable to the blood spaces in the second (tubal) ovum, where there is no question as to the possibility of their being glands.

In at least two places the blood spaces can be seen opening into the implantation cavity or intervillous space. At these points there is no indication of any proliferation of the endothelium over the surface of the implantation cavity. Nor is there any definite or continuous lining of that space by syncytium. On the contrary the space is lined somewhat indiscriminately by fibrinoid tissue and trophodermic elements.

The œdematous condition of the decidual stroma is noted in most early ova, but it is usually associated with a certain amount of congestion of the blood vessels throughout the whole decidua. Jung refers particularly to a condition of venous hyperæmia. In

my specimen there is no marked congestion in the decidua vera, but merely some enlarged veins here and there. There is in the decidua basalis, especially around the border zone, a noticeable escape of red blood corpuscles into the stroma. This condition is more widespread in my specimen than in Jung's, where it was confined to the immediate neighbourhood of the border zone. I have not detected anything that could be interpreted as the formation of new capillaries in this zone. This phenomenon is described by Peters, particularly in the capsularis. White blood cells, or at least what appear to be lymphocytes, are to be found in the stroma particularly around the vessels, not only in the decidua basalis but in the vera and capsularis.

The embedding of the uterine ovum.

In connection with the decidua capsularis I have already mentioned that the embedded ovum projects to a quite unusual degree above the surface of the surrounding decidua. The only other specimens which resemble it in this respect are those of Leopold, Cova, Marchand and Rossi Doria—particularly the last-named. This circumstance has led Cova to suppose that the ovum was necessarily arrested by a projecting piece of the endometrium, upon which it proceeded to engraft itself. Rossi Doria, on the other hand, finds in it support for the older view of the process of embedding, namely that the ovum comes to rest on the surface of the mucous membrane and is gradually enclosed by an upgrowth of decidua capsularis around it. He modifies it, however, and states his belief that the implantation is effected by a combined method—the ovum eroding its way through the superficial epithelium into the substance of the mucous membrane, while at the same time the surface decidua grows up round it as a true 'capsularis.'

In the present specimen the projection of the ovum is even more marked than in Rossi Doria's specimen, and, as has been said, gives it almost the appearance of being pedunculated. At the same time I do not consider that there is any need to explain this by any peculiarity in the mode of implantation. Cova's view can neither be substantiated nor denied. It remains a mere pious opinion. On the other hand there is no evidence to support Rossi Doria's view. There is, it is true, no mushroom-like stopper of fibrinoid material ("gewebspilz") at the point of entrance, as in Peters' and some other cases; but there is clear evidence that the polar portion of the decidua capsularis consists practically entirely of fibrinoid material—the natural interpretation of which is that it represents the stretched out "closing coagulum" at the point of entrance of the ovum. Moreover there is absolutely nothing to indicate any active growth of the decidual elements in the decidua

capsularis, such as one would expect if it were actively growing up around the ovum. There is, for example, no sign of cell division.

I believe it to be more likely that there was originally a closing coagulum at the point of entrance, but that it has disappeared partly by absorption and partly by stretching. Furthermore the projection of the ovum is probably to be explained by two things—firstly, that the ovum may have been rather superficially embedded, and secondly, that as a result, the direction of least resistance, in which growth would naturally take place, was, even more markedly than usual, towards the surface.

Another interesting point in the present specimen, which at the same time goes to prove that the capsularis is no new formation, is the presence of relics of glandular structure in it well up towards the polar region. This is clearly shown in the photographs. (5 & 6).

Embedding of the tubal ovum.

At this stage it is interesting to compare and contrast with the conditions in the early uterine pregnancy those of the second specimen—the early tubal pregnancy.

The trend of a good deal of the recent work upon tubal gestation has been to throw the responsibility for this abnormality more upon the ovum than upon the tube. The old idea of preceding disease of the tube is only rarely borne out by an examination of the affected tube. In a great many cases the tube is remarkably healthy. This is so in the present instance, the rest of the tube showing no abnormality, nor trace of disease.

When we look to the ovum for an explanation, we are forced to conclude that in some circumstances it must be fertilized at or near the ovary, and that its development goes on so rapidly, or it is so delayed in reaching the uterus, that it becomes provided with the necessary trophodermic apparatus for embedding itself while still in the tube. In the present instance there is a particularly beautiful illustration of the truth of this view. In the ovary removed along with the pregnant tube there is no recent corpus luteum. On the ovary of the other side there was observed at the time of operation what we took without hesitation to be a recent corpus luteum. The ovum must therefore have travelled from the one side of the uterus to the other. Further, assuming that it was fertilized on the surface of the ovary from which it arose, and that the journey to the mouth of the opposite tube occupied several days, it is possible that by the time it arrived at this point it was ready to implant itself. Under these circumstances it is less surprising that it engrafted itself on the fimbriæ, instead of passing along to the ampullary portion of the tube, which is so much more common a site for implantation.

It must be admitted that the assumptions thus made are in the present state of our knowledge not susceptible of proof. We have

no actual knowledge of the frequency or rarity of the presence of spermatozoa in the peritoneal cavity, although the possibility of it is proved by cases of ovarian and primary abdominal pregnancy. Again we have no proof that the journey from the one side of the uterus to the other must occupy the ovum for several days. Lastly we have no certain knowledge of what, in the case of man, brings the ovum to rest either in the tube or the uterus, or of the condition of the developing ovum prior to the blastocyst stage. As a matter of fact these considerations are rather lost sight of in all theories of tubal gestation which seek to place the whole blame upon the tube.

It is legitimate to conclude that when the human ovum escapes from the ruptured Graafian follicle it is surrounded by the *zona pellucida,* and outside that by some of the immediately adjacent cells of the *discus proligerus,* the so-called *corona radiata.* Through these two coverings the spermatozoon penetrates, and development begins. The subsequent fate, as well as the function, of the corona radiata is unknown. In his Hunterian Lectures Professor Robinson has suggested that its cells may provide pabulum for the growing ovum while the latter is still in the higher reaches of the Fallopian tube. On the other hand it may go to form an albuminous coating, such as is found in the ova of several animals—the dog, and the rabbit, for example. This layer by its stickiness probably acts as a means of fixing the ovum to the mucous membrane. We do not know, however, that any such layer is formed in the human ovum, and apart altogether from it we are still in the dark as to how long the zona pellucida persists. In some animals—Tupaja javanica according to Hubrecht—it disappears at the two-celled stage. In the mouse and rat it persists to about the eight-celled stage, and even later in the bat. In the mole and the shrew it persists until the embryonic ectoderm comes to the surface of the ovum, while in the dog and the ferret it does not disappear until after the appearance of the primitive streak and the commencement of the formation of the mesoderm. Generally speaking it disappears early in those animals in which the ovum is early embedded in the decidua.

The functions of the zona are somewhat obscure. In all probability, according to Robinson, it is not so much a protection from actual pressure as from premature attachment. Thus in animals in which the embryonic ectoderm comes to lie on the surface of the ovum the zona persists until the embryonic ectoderm cells have reached a stage of development at which they no longer tend to fuse with the decidua. On the other hand, in animals such as the mouse, rat, guinea-pig, hedgehog, and bat, in which the embryonic ectoderm never comes to the surface but remains separated from the maternal tissues by other cells or a fluid-filled space of considerable size, the zona disappears at an early stage.

In these animals its function is probably just to prevent the union of the chorionic cells with the decidua until the ovum has attained a sufficient size. To this second class there is reason to believe that man and the apes also belong.

Bearing in mind the possibilities lying behind our ignorance of these points it becomes apparent that in this case, and in a great many other cases of tubal pregnancy, the arrest of the ovum in the tube may be due to the premature or the excessive development of the hypothetical albuminous layer around the ovum, or to the premature disappearance of the zona pellucida. Of the conditions governing any of these circumstances we are totally ignorant.

But to return to the present instance, I believe that my assumptions, although they cannot be proved, afford the simplest explanation of the conditions found—namely that the journey of the ovum from the right ovary to the mouth of the left tube—a journey considerably longer than that to the interior of the uterus by the ordinary route—occupied the ovum for several days, and that by the time it reached the tubal infundibulum it was ready, in a perfectly normal sense, to embed itself. Moreover if this occurred in the case of a woman with tubes that were, so far as could be seen, perfectly healthy, it is probable that a similar explanation underlies quite a number of other cases of tubal pregnancy.

The actual process of embedding in the case of tubal pregnancy is now regarded as being as strictly analogous to what occurs in the uterus, as the differing circumstances will allow. There is every reason to believe that the ovum eats its way through the superficial epithelium of the tubal mucosa exactly as it erodes its way into the endometrium. The first difference met with is the absence of anything like a thick stroma underneath the epithelium of the tubal mucosa. In most cases therefore the ovum eats its way right into the muscular wall of the tube, and forms there its implantation cavity. This is probably a slower process than sinking into the substance of the soft endometrium, and accordingly the surface epithelium does not get the same chance of closing over it as the decidua capsularis has in the uterus. Thus the tissue which separates the ovum from the lumen of the tube degenerates almost as soon as it is formed, and is present in most specimens as a membrane composed largely of fibrin. To it is applied the name "capsular membrane." In some cases, however, the ovum sinks deeper, and several authors have demonstrated tubal muscle elements in the capsular membrane.

In many cases there are obvious attempts at the formation of a decidua. The relative absence of a connective tissue stroma makes it impossible for this to be a marked feature in the tube, but even in the presence of such stroma the reaction is often absent, and if present is only in small isolated patches. The vascular changes in

the immediate neighbourhood of the ovum, and the effects of the action of the trophoderm are analogous to what is found in the case of uterine pregnancy.

The above applies in the main to ampullar pregnancies, which form the majority of tubal gestations. But it will be seen that, *mutatis mutandis*, it explains all the appearances of the present specimen.

Thus the saucer-shaped hollow in the fimbriæ, in which the ovum rests and to which it is attached, shows that the ovum had eroded its way through the surface epithelium into the substance of the fimbriæ. This portion of the fimbria or fimbriæ represents the decidua basalis, and is the seat of a marked reaction similar to what is found in the true decidua basalis. There are no decidual cells, but merely an enlargement of some of the muscle and stroma elements. The whole tissue is markedly œdematous, and there is a striking enlargement of the blood vessels with the formation of very large blood spaces separated from the intervillous space only by thin films of tissue.

A capsular membrane has been formed, which in the 'equatorial' parts presents the structure of the fimbriae. Over more than half the ovum, however, this structure is replaced by blood clot woven through with coarse streaks of fibrin, and irregularly interspersed with cells. Most of the latter appear to be trophodermic in nature. Whether this capsular membrane originally consisted to a greater extent of fimbrial tissue which has subsequently undergone fibrinoid degeneration, or whether it has been from the outset largely made up of blood clot, it is impossible to say. The appearances incline me to the latter view, and I think the large expanse of fibrinous clot must be regarded as corresponding to a closing coagulum at the point of original entrance of the ovum, which has been excessively stretched.

This in itself, however, is not a sufficient explanation, as it cannot be held to include the whole of the blood clot that was seen at the time of operation, and is shown in the photograph. To cause this there must have been some bleeding, and although I have not been able to detect the source of the bleeding in the course of the microscopic examination, yet I think it must have come in some way from the surface of the equatorial portion of the capsular membrane. It is likely that the blood oozed out very slowly, and having percolated gradually round the ovum formed the clot. In doing so it probably reinforced the earlier fibrinoid capsule just referred to. Some such occurrence as this is at least possible considering the very shallow implantation of the ovum, and the fact that, as has been shown in my other specimen as well as by many other observers, the vessels of the decidua may be opened up by the influence of the chorionic elements at some little distance from the actual chorionic cells.

In this connection I gave full consideration to the possibility of the specimen being, as I thought probable at the first, one of a tubal abortion—that is to say, of an ovum which had been implanted farther along the tube, and had then been dislodged and expelled to the abdominal ostium without the embryo being killed, and which had then engrafted itself secondarily upon the fimbriæ. As already stated, however, the rest of the tube appeared perfectly healthy, and in the parts examined microscopically there was not the faintest sign of any undue congestion, still less of any destruction of the lining epithelium. The normal outline and shape of the tube were unaltered. Further, the clot, on the outside at any rate, appeared quite fresh and recent, and therefore must have been formed long after the ovum had attached itself to the fimbriæ. It is, of course, generally agreed that after such an abortion the tube very quickly returns to its normal condition, but I hardly think it could do so in quite such a short time as might have been available in this case, or to such a complete extent in that time. I believe therefore that I am right in regarding this as a primary infundibular pregnancy.

From the nature of the site of implantation there can be nothing to correspond to a decidua vera, and, as has been stated, there is practically no change in the rest of the tube. Even the vascular engorgement is very localised and does not extend beyond the affected fimbriæ. In this it resembles the intra-uterine specimen, where the engorgement was practically confined to the decidua basalis.

The surface epithelium present on the distal side of the fimbriæ shows no sign of enlargement or of degeneration or maceration. Even the cilia can be readily detected.

I have not detected any blood vessels opening directly into the intervillous space.

The Border Zone.

The border zone or transition zone or "Umlagerungszone" marks the division between the fœtal and maternal tissues. As might be expected it is not a sharp line, for it is in truth the fighting line where the conflict between the maternal cells and the invading trophoderm takes place, and it is strewn with such of the dead on both sides as have not already been carried off the field or otherwise disposed of. In the earlier stages there is even more evidence of the deadly nature of the conflict than in the later stages. The Bryce-Teacher ovum, for example, has a very marked zone containing degenerated and necrotic cells of both maternal and fœtal origin. But in the later stages there is evidence that the maternal tissues are succeeding in limiting the invasion. Thus we do not

find the large degenerated "maternal" cells described by Bryce and Teacher in the margin of the intervillous space.

Put briefly, the border zone in the first specimen consists of decidual stroma very much torn up by œdema or by the influence of the trophodermic elements, and invaded every here and there by these elements. This invasion is most noticeable where the cell columns of trophoderm are attached to the surface of the cavity. There is thus an irregular distribution of trophodermic cells all round the cavity, but no definite layer of syncytium such as is found later—the "basal ectoderm" of Langhans. Streaks and patches of fibrinoid material are also irregularly present all round the cavity, and no doubt represent Nitabuch's fibrin layer. This tissue is, however, not sufficiently regular in its distribution to warrant one in regarding it as a third layer separating material and fœtal elements, as is claimed by Fetzer.

Jung and Frassi have pointed out that the infiltration of the decidua with leucocytes enables one to differentiate between the fœtal and maternal tissues, because these cells are unable to penetrate the fœtal area. In my specimen there is a general infiltration by leucocytes through the decidua, and particularly in the neighbourhood of the ovum. At the same time their presence is not sufficiently marked to enable me to regard them as a satisfactory boundary line.

I have mentioned that the decidual tissue is in parts so opened out as to permit the escape of blood from the underlying blood spaces. I have also mentioned that the whole tissue is infiltrated with red blood corpuscles in the neighbourhood of the ovum. The result is that round the edge of the implantation cavity there are numerous tiny bays or pools of blood into which the red cells seem to be filtering through the decidual stroma. The edge of the cavity thus somewhat resembles the sea shore at low tide, when there are many small pools communicating with the sea on the one side and receiving innumerable small runnels or streams of water from the other side.

There is also a clear connection on a larger scale between the blood in the implantation cavity and the maternal blood spaces. In two instances there can be seen opening into the cavity blood vessels, which can be traced in the other direction into the large blood spaces of the decidua basalis. In this respect the specimen agrees with those of Frassi and Cova.

The tubal specimen agrees in the main with what has been said of the uterine one. The streaks of fibrin are on the whole more uniformly present. This is particularly so on the inside of the capsular membrane. At the same time trophodermic cells may be seen far beyond it, and it can in no sense be regarded as a dividing line between fœtal and maternal tissues.

A very interesting point of difference is that in the tubal specimen the invasion of trophodermic elements into the tube wall is distinctly more marked. Detached masses of both syncytium and Langhans' cells may be seen at quite a considerable distance from the edge of the gestation cavity, and, furthermore, the natural arrangement of the maternal tissues in the border zone is much more destroyed. The whole tissue in the zone is indeed ploughed up to a quite extraordinary extent.

It seems quite fair to assume that this is due to the absence of the decidual cells, and of the support and resistance which they lend to the maternal tissues. At any rate this is a feature that has been noted frequently in tubal gestations, where deportation of portions of syncytium along the blood stream is not an unusual occurrence.

The stroma of the tube wall in this zone is infiltrated with red blood cells, but there is not the same formation of small bays opening into the intervillous space, nor have I seen any vessels opening directly into the space. The leucocyte infiltration is a much less marked feature of this specimen.

The Intervillous Space.

In the uterine specimen the intervillous space is quite full of maternal blood. In the tubal specimen it is not so, but the space contains several considerable blood islands, as well as innumerable individual red corpuscles, clinging to the surface of the villi, and lurking in many of the smaller interstices. This forms clear evidence of its having been full of blood.

There can be little doubt that this is the normal condition, and that there must be a slow circulation by means of such channels as have been described. The force of the blood stream must be broken by the intervention of the large blood spaces in the decidua basalis, and the danger of a forcible escape of blood into the intervillous space during these days of slender attachments of the ovum greatly obviated. The arrangement is indeed an ideal one for securing a safe and slow circulation.

Several specimens have been described in which there was no blood in the intervillous space, and on the strength of such a specimen, otherwise apparently normal, Marchand actually stated the opinion that it was the normal condition. The presence of blood in the Peters' ovum, for example, he regarded as due to the effects of the caustic alkali poisoning from which the patient died. Marchand's own specimen, however, was obtained from a woman who died of severe internal hæmorrhage, and this may explain the absence of blood from the intervillous space. Since then Herzog's specimen, obtained under almost ideal conditions, has been found to have the space full of blood; while Frassi, whose ovum did not

contain blood, regards that as an abnormal feature, due in all probability to the squeezing of the uterus during its removal by vaginal hysterectomy.

The fact that the blood, although outside the vessels, does not clot, has been pointed out again and again. It is the only instance in the body of such a phenomenon in connection with normal (non-menstrual) blood. The explanation would seem of necessity to lie in some attribute of the trophoderm elements—both the cellular and the plasmoidal layers—which prevents clotting. Hofbauer has suggested that this may be of the nature of a fine layer of albumose secreted by the trophoderm.

The further contents of the implantation cavity are in both cases the villi, and the outgrowths of the trophodermic epithelium. In both specimens the epithelial covering of the chorionic membrane is very similar—a single layer of Langhan's cells regularly arranged, and outside that a thin layer of syncytium. In the tubal specimen, which is obviously older, there is a beginning differentiation into chorion laeve and chorion frondosum. In one or two parts also the villi of the second specimen show the commencement of capillaries in the mesodermic core.

In the first specimen all the villi, and in the second case the shorter ones which do not reach to the surface of the tube wall, terminate in great outgrowths of trophoderm. These cell columns branch very irregularly, uniting with each other laterally, and reaching out to the surface of the implantation cavity to which they attach themselves. At the points of attachment the cells invade the maternal tissues as has been described.

The "Third Layer."

Before passing on to the discussion of the trophoderm, a brief reference must be made to the question of the existence of the much debated third layer between the two-layered trophoderm and the decidua. In some of the lower animals a series of giant cells has been described lying between the trophoderm proper and the maternal tissues. They first appear about the time that the embryonic mesoderm is formed. In the mouse and the hedgehog, for example, they are frankly phagocytic, and portions of red blood corpuscles and decidual cells may be seen in their interior. Hubrecht accordingly called them *deciduofracts*, and they are regarded as a means of enlarging the implantation cavity.

In the mouse, to quote from Lochhead's admirable summary, "Duval stated that each was derived from a cell of the fœtal ectodermal wall of the yolk sac, and later from a cell of the ectoplacental cone. As they increase in number, they form a distinct layer between the yolk sac and the wall of the implantation cavity, and some wander into the decidua and lie singly or in groups. In their

interior degenerating leucocytes are frequently seen. Sobotta also stated that they were fœtal in origin, and helped to fix the ovum and erode the maternal capillaries. More recently Kolster has brought forward evidence from their histological appearance that they are transformed decidual cells, and this is strongly supported by Disse's investigations on the field-mouse, in which the giant cells are found before the ovum has become embedded, and the first to appear are at an appreciable distance beneath the surface epithelium. A second series of smaller size appears later in the lumen and wall of the implantation cavity. Jenkinson also recognized two groups, but assigned to them different origins, fœtal in the " Eikammer " and maternal in the decidua.

All authorities agree that they are phagocytic. The tissue around them undergoes fatty degeneration, and in their interior may be seen remnants of connective tissue and endothelial cells and fat globules. Many capillaries are ruptured, and red and white blood corpuscles are also absorbed. Such an absorption of maternal tissue by the giant cells leads to an increase in the size of the implantation cavity, and a thinning of its wall. In spite of their abundant supply of nutriment, their life-history is short. No cell divisions occur, and they soon degenerate. Their contents are absorbed by the trophoblast, and their protoplasm shrinks to form a rim around the nucleus. Later still their remnants are also absorbed."

I have quoted this passage at length to show how dubious are the nature and origin of these cells even in lower animals, in which such a problem is much easier of solution than in man. Bryce and Teacher have described a number of somewhat similar cells in their human ovum, " lying free in the blood space within the necrotic layer of the decidua " in small excavations or bays. " Within the layer itself are seen spaces enclosing cells in different phases of degeneration whose nuclei are identical with those of the completely free cells, and the protoplasm stains the same dusky-red in both cases." They admit that " these cells closely resemble bodies which are certainly cross-sections of plasmodial strands, but when traced through the sections it becomes quite certain that they are not continuous with the plasmodium, but are really isolated cells." Largely because they agree in nuclear characters and protoplasmic reactions with cells farther out in the decidua which are obviously degenerating maternal cells, the authors come to the conclusion that they are more likely maternal in origin. The cells are, they state, " quite different from the wandering trophoblast cells of later phases."

In Peters' ovum there are also some large cells which the author compares to the deciduofracts of the hedgehog. Siegenbeek van Heukelom, too, describes such a layer, and regards its cells as

fœtal, derivatives from the cytotrophoderm. "Whatever their origin," says Lochhead, "the mononuclear cells in man appear to be engaged in disintegrating mucosal tissue, and producing a zone of coagulation necrosis, *i.e.*, a symplasma, around the trophoblast. But they differ from similarly situated cells in lower animals, *e.g.*, the mouse, in showing no evidence of ingestion of formed tissue-elements."

The conclusion of the whole matter would therefore appear to be that it is a perfectly open question whether the cells described in the early human ova are really comparable to the deciduofracts of the lower animals. My own specimens throw no light whatever on the problem. There are, as has been described, numerous wandering giant cells in the outer part of the trophodermic sheath and intervillous space, but these are all so closely similar to the cross-sections of plasmoditrophoderm strands, that their origin from these cannot be held in doubt, even although they are quite detached and isolated. It is, however, quite possible that such cells do occur in the earlier stages, such as the Bryce-Teacher ovum, and very soon thereafter disappear. As has been stated, they are very short-lived even in the lower animals.

The Trophoderm.

The cytotrophoderm cells (Langhans' layer) correspond closely in both ova. In the chorionic membrane they are arranged in a single row. This arrangement is continued over the trunks of the villi, but at the tips of such villi or their branches as do not reach the periphery of the intervillous space, they become heaped up into the cell columns described. Where the arrangement is regular the cells are rounded, and the round or oval nuclei occupy most of the cell space; but in the cell columns they are so massed together that the shape becomes in many cases irregularly polygonal. The size of the cells also is greater in the columns, and where they spread out over the surface of the maternal tissues they have a superficial resemblance to decidual cells. Their direct continuity with Langhans' layer as well as a closer study of their appearance, however, make it quite clear that, as has also been shown by Williams, Berkeley and Bonney, and a host of other observers, they are not maternal in origin.

In both specimens these cells invade the maternal tissues, and may be detected at some distance from the edge of the implantation cavity. This is particularly the case in the second specimen, and is probably, as I have indicated, due to the absence of the decidual reaction.

A comparison of the syncytium, or more correctly the syncytiotrophoderm, in the two specimens reveals several very interesting points.

In the uterine gestation it is spread so thinly over parts of the chorionic membrane as to be hardly recognizable. On the outside of the villi it is more uniform in arrangement, and amongst the cell columns it is to be found in clumps and strands. (10). The protoplasm is always foam-like or finely granular, and more or less studded with fine brownish granules. In only one or two instances is there any suggestion of a striated border. Over the chorionic membrane and villi the nuclei are mostly long, flattened oblongs, staining diffusely. Elsewhere this type of nucleus is replaced in parts by large, pale, and often crenated and shrunken nuclei, containing one or two darkly staining nucleoli. Numerous apparently detached islands may be seen, some containing the large pale nuclei, others groups of the small, dark, round ones, probably the oval ones on section. In many cases these islands may be traced through serial sections to the strands mentioned. Others are quite detached, but there can be no reasonable doubt that their origin was the same.

In the tubal gestation the syncytium is more uniformly arranged over the outside of the entire chorionic membrane, and is always easily recognizable. On the outside of the villi it is more exuberant in growth, and the intervillous space contains a much greater number of buds and detached islands. As before some of the islands or giant cells can be traced by serial section to villus buds, while others are entirely detached. The protoplasm is again very definitely foam-like, and stains uniformly with eosin, and apparently also with the hæmatoxylin, to judge from the purplish-red hue. The nuclei are preponderatingly rather small and dark and are very numerous. A well marked striated border is visible in many places. Over the chorionic membrane it is but seldom seen; over the villi it is more frequent; whilst it is best and most constantly seen on the syncytial buds and the detached giant cells. Nowhere is there any appearance of the brown granules so uniformly present in the other specimen.

Of all tissues in the whole realm of histology the syncytium has almost certainly been the most discussed during the last twenty-five years. Peters, whose classic description of his ovum, threw the first definite light upon it, mentions some ten distinct theories as to its nature and origin! Since that publication it has been demonstrated with a gradually increasing clearness that the human ovum is embedded in much the same way as in the case of the guinea-pig, that is to say, interstitially in the uterine mucosa. This knowledge at once threw out of court at least two of the more prominent views of its origin—namely from the surface epithelium of the endometrium, and from the glandular epithelium. A further and still more conclusive proof of the erroneousness of these views has been obtained more recently in the numerous carefully described

cases of ovarian pregnancy, in which the syncytium is found to be identically the same as in an ordinary intra-uterine pregnancy.

This leaves only two views of importance, one that it arises from the endothelium of the vessels of the decidua, and the other that it is fœtal in origin. The former view was last championed by Pfannenstiel, all other observers having abandoned it in favour of the latter. Recently, indeed, Frassi has given it the *coup de grace* by showing from Pfannenstiel's own figures that what that observer regarded as endothelium may with much greater probability be looked on as an epithelial rest—that is, a portion of epithelium remaining in a gland, which has been opened into laterally by the trophoderm, and converted into a blood space. This occurrence has been referred to already in connection with the nature of the blood spaces in the decidua basalis.

In one area my first ovum shows an appearance which might readily have been taken to support Pfannenstiel's view—namely a blood space lined with "syncytium." (7). The cells have lost their outlines and the nuclei are elongated and pale. The protoplasm contains the brownish granules which are found throughout the syncytium in this specimen. I believe, however, that this tissue is not syncytium in the sense of plasmoditrophoderm, but rather a degeneration of the maternal tissues lining the space. In other words, it corresponds to what, as I mention below, Jung describes as "symplasma maternum conjunctivum."

The fœtal origin of the syncytium is indicated in a much more positive way in such an ovum as Bryce and Teacher's. In it there is no connection between the syncytium and the maternal tissues, whereas it is in intimate connection with the blastocyst wall.

While, then, it is generally agreed nowadays that the syncytium is the outer layer of the trophoderm, we have no exact knowledge of the earlier stages of its development or of its essential nature. Peters regarded it as the reaction of the cytotrophoderm to contact with the maternal blood, and both he and Jung have described appearances which led them to think that it is formed out of the cellular layer underlying it. The only appearance in my specimens which might be taken as supporting this view, is the presence of syncytial islands in the centre of some of the cell columns. This appearance can, however, also be explained by the fusion of two parallel cell columns, and the consequent enclosure of the syncytium between them.

Hubrecht and Bonnet regard the syncytium as an indication of intense functional activity on the part of the trophoderm when it comes into contact with the maternal structures. This implies an organic reaction of a more or less automatic kind between the fœtal and maternal tissues, just as Peters' theory does. Whether or no this be the case, the term "contact" is certainly too restrictive.

For there are large stretches of syncytium that never come into contact with the maternal tissues—such for example as the layer covering the chorionic membrane in between the villi. It is true that in some cases, as in my first specimen, the syncytium is irregular in its distribution over that area, but still it is present to some extent, and in many other specimens it forms a complete covering. Even in the earliest ovum—the Bryce-Teacher specimen—there is much syncytium that is not, and probably never was, in contact with the maternal tissues. Accordingly the stimulus to the reaction, if such it be, must be more far-reaching than actual contact.

From the study of my own specimens I am not inclined to regard the syncytium in the sense of a reaction of the trophoderm cells to contact or even association with the maternal tissues or blood. Such a reaction would be universal. But we find cytotrophodermic elements in intimate contact with the maternal tissues and blood without their being changed into a syncytium. On the other hand the syncytium has everywhere, except in the degenerate forms, the appearance of being an intensely active tissue, designed primarily for the dissolution of the maternal tissues, and possibly later for the less aggressive functions of selecting and transmitting nutriment. I would therefore subscribe to the view that the syncytium is probably the outer layer of the trophoderm from the very outset. This does not, of course, exclude the possibility of its being formed continuously from the cytotrophoderm. Such an origin is most probable, but it is not specifically called out by association with the maternal tissues. Apart from this question of its origin, Grosser's view as to its changing functions, which will be mentioned in a later paragraph, seems the one which best suits our rather conflicting knowledge of the tissue.

Before elaborating this latter view, however, it is necessary to consider and contrast the syncytium as present in such an early specimen as the Bryce-Teacher ovum and as present in older ova.

The Bryce-Teacher ovum is surrounded by a loose spongework of syncytiotrophoderm, which "forms an extraordinarily extensive spun-out investment for the ovum. It occurs in masses, bands, or threads. The nuclei are invariably small and stain darkly." Peters' ovum represents a stage subsequent to this. In it the syncytium is distributed around the blastocyst in an extremely irregular fashion, but the "spongework" has largely disappeared. In the still older ova the arrangement becomes increasingly uniform as a layer on the outside of the cytotrophoderm, and the only trace of the previous arrangement is to be found in the irregular strands and masses interspersed among the cell columns towards the periphery of the intervillous space.

Some of these latter masses are regarded by Jung as degenerated

portions of the syncytium or of maternal tissues as the case may be. These he terms symplasmata—either symplasma syncytiale fœtale or symplasma maternum conjunctivum according to their apparent origin. Another point of possible distinction between the earlier and the later syncytium is that the latter shows a striated border in many cases.

It will be seen that my first specimen corresponds to Jung's description. The masses and strands of syncytium containing large shrunken nuclei are what he calls symplasma syncytiale fœtale, and the fact that in my specimen these nuclei are pale and ghost-like, while in his they stain diffusely, is probably due to a more advanced degeneration. One instance of the symplasma maternum I have already referred to. (7). In the second specimen there is very little of this symplasma formation. On the other hand the striated border is well marked in it—both possibly points indicative of a more advanced stage of development.

Grosser makes what seems a helpful and thoughtful suggestion when he speaks of there being "so to speak" two generations of syncytium. "The first is associated with the implantation and with the intense histolysis which leads to the formation of the cavity of the egg capsule; it is represented by the syncytial shell of the Bryce-Teacher ovum." As time goes on this early syncytium may be supposed to degenerate into the symplasma syncytiale, which has all the appearance of a degeneration product. Meantime the histolytic function is largely usurped by the cytotrophoderm, which is seen invading the maternal structures to a much greater extent than the syncytium. The newer generation of syncytium, on the other hand, may be considered to assume either a secretory or an absorptive function, of which the striated border is probably an indication. This supposition involves the constant formation of new syncytium, and this can most easily be accounted for by the view that it is formed continuously from the cytotrophoderm. The appearances noted by Peters, Leopold, and Jung suggesting an actual stage of transmutation confirm this. At the same time it is probable that the syncytium has in itself powers of reproduction, for syncytial buds may be seen in the placenta long after the cells of Langhans' layer have ceased to exist. Still, the disappearance of the cellular layer does largely coincide with the time when the demand for the formation of syncytium in large quantity begins to diminish, and accordingly the cellular layer may well be regarded as to a great extent, although not exclusively, the mother-layer of the syncytium.

In this connection I should like to point out that, even assuming the truth of this view, there may be other reasons associated with the relatively early disappearance of Langhans' layer in the placental villi. Lochhead has indicated one possible theory, which

is suggestive. He points out that during the early weeks of development, in which both coverings are present over the villi, the different organs of the fœtus, indeed the different tissues, are hardly sufficiently developed to be able to conduct their own metabolic activities, even on a limited scale. More selective discretion must therefore be exercised for them—in other words there must be a more rigid filtering and selection of the substances passed through the villus epithelium to the fœtal blood. In the later months, on the other hand, the organs become increasingly more and more able to select their own particular forms of nourishment, and to carry on their own individual metabolism. The efficiency of the placental filter may therefore be relaxed. This stage coincides with the gradual disappearance of Langhans' layer.

The striated border of the syncytium (27 & 28) has been studied mainly by Bonnet, Marchand, and Lenhossek. It has been described as a row of prickle processes—the Bürstenbesatz—and as a ciliated margin. Lenhossek studied it in a fresh specimen and maintains that the processes are not motile, but that they are provided with basal granules in the cuticle, which may be observed in specimens stained with iron hæmatoxylin. No one else has described such granules, and I have entirely failed to see them even in specimens stained with iron hæmatoxylin. The striated margin has, however, been described in quite a number of the young ova, including those of Jung and Herzog. Peters is not definite on the point but speaks of "a delicate and thin, strongly refractive deposit, slightly frayed at the edges, on the surface of the syncytium." Rossi Doria regards it merely as a deposit of broken-up blood corpuscles on the surface of the syncytium.

Peters' description applies closely to many areas in my tubal ovum, and in regard to Rossi Doria's view it must be admitted that there is frequently a deposit which is quite recognizably made up of broken-up blood cells. But in many other parts the appearance is more definite, and, moreover, I have seen it in syncytium buried in the substance of the decidua capsularis, where it would be impossible to imagine an accidental deposit of broken-down blood cells.

The tubal specimen affords the opportunity of contrasting in one and the same section this striated cuticle and the ciliated surface of the tubal mucosa, which is still quite obvious on the outer side of the fimbriæ. The comparison shows that the tubal cilia are more slender, as might be expected since they are motile; whereas the "rods" of the striated border appear stiffer and straighter, and do not suggest the possibility of movement. In a word, they are more rod-like than the cilia themselves.

The question arises whether in the absence of any power of movement these processes are really rods, or whether the appear-

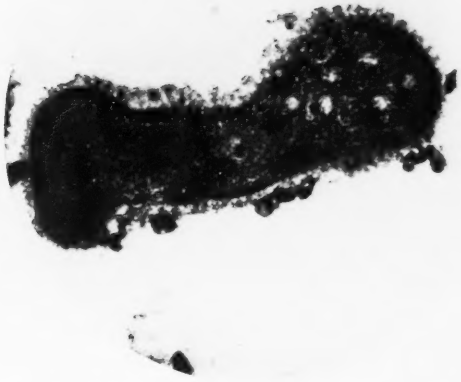


FIG. 28.—Striated border of syncytium. On the lower edge several adherent blood corpuscles may be seen.

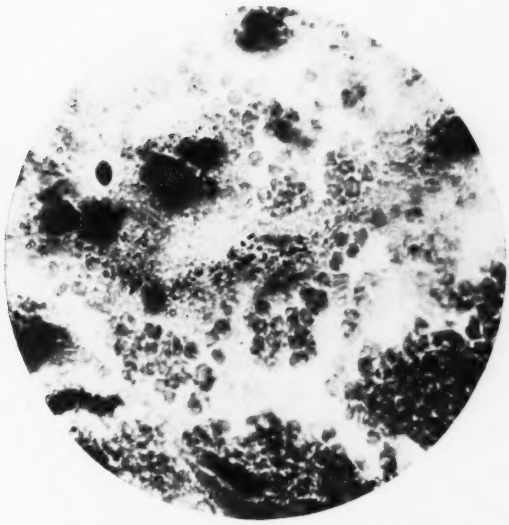


FIG. 29.—Syncytial strand surrounded by maternal blood. The foam-like structure of the syncytium may be seen, also the dark granules scattered through it. The outline of the syncytial strand is lost, as the lens was focussed on the granules.

ance may not be due to the presence of pores out of which secretion is passing. Against their being *merely* pores is their extraordinary regularity as well as the straight stiff appearance mentioned. At the same time it is difficult to conceive of their being unassociated with some function either of secretion or absorption, and accordingly it is quite possible that the spaces in between them represent pores.

Apart from such functional reason for their existence it might be conceivable to regard them as a phylogenetic memory corresponding to the ciliated epithelial covering of some elementary marine forms of life. But this is harking back to a very remote ancestry indeed, and against it must be placed the fact that, so far as our knowledge goes, this appearance is not found in the earliest known syncytium (as in the Bryce-Teacher ovum) but only in the somewhat later stages.

The appearance of small refractive brownish granules scattered throughout the protoplasm, and more particularly the perinuclear protoplasm, of the syncytium in my first specimen is a little difficult to explain (29). Exactly similar appearances are figured by Marchand and by Aschoff and Apfelstedt, and described by Eden. In these cases they are undoubtedly fat granules, the preparations being fixed in Müller's or Flemming's solutions and stained with osmic acid. My specimen was fixed with formalin, and passed through alcohol and xylol into paraffin, so that it is unlikely that any fat remained. Moreover the granules appear in all the sections stained with hæmatoxylin and eosin. One slide I re-stained with osmic acid, but the granules remained exactly as before, and did not take on the osmic acid. It may be concluded therefore that they are not fat, however closely they resemble it in appearance and distribution. For glycogen none of my slides were stained, and that also may be put out of account.

Peters describes the presence of red and white blood corpuscles, both normal and degenerated, in the syncytium. But in his case this was an occasional occurrence, although it led him to the rather extreme conclusion that the blood cells were capable of taking part in the formation of syncytium out of their own elements. The appearances in my specimen are, however, quite apart from this. The granules are universally present throughout the syncytium and symplasma, and in practically no other tissues. Here and there I have seen isolated granules in the decidua or trophoderm cells. In the syncytium, on the other hand, they are so constant as to form in this particular specimen a fairly accurate means of recognizing that tissue.

This uniformity and peculiarity of distribution make it quite clear that it is not an accidental deposit of pigment, and unlikely that it is a degeneration product. The close similarity of their

arrangement to the fat figured by Marchand and Aschoff, and their translucent refractile appearance led me to think that they might be lipoids in a crystalline state. Professor Lorrain Smith very kindly examined several sections with me, and by means of the polarizing microscope demonstrated that this idea was wrong. He, however, suggested another explanation which is very probably correct. In his view these granules, and the very similar granules seen in the spleen, are composed of molecules of blood-pigment adherent to a minute droplet of fat or lipoid. If the tissue is fixed and stained for fat, the granules appear as fat droplets. But in a specimen fixed like mine the lipoid nucleus is dissolved out, and the molecules of pigment are left adhering to one another and forming the granules that take on the eosin. This view I have not been able to test experimentally, but it is certainly the most likely explanation of this interesting appearance. It receives support also from the strong similarity of the granules to those described by Jenkinson as occurring in the trophoblast of the sheep. These he proved to consist of hæmoglobin derivatives from the ingestion and fragmentation of red blood cells. Bonnet regarded the pigment as hæmatoidin, but Jenkinson failed to confirm that opinion by means of the spectroscope.

This absorption of blood-pigment may, according to Lochhead, be due either to the ingestion of red cells by the trophoblast, or to laking of the blood on the surface and the absorption of the hæmoglobin. He is unable to suggest the exact significance of the appearance of the granules. "Iron-free pigment is probably a waste product, while iron-containing pigment is stored in the fœtal organs. Whether the fœtus subsequently synthesizes part of the organic iron compound into hæmoglobin, or absorbs minute quantities of hæmoglobin as such, according to its requirements, is unknown." At this very early stage the iron requirements of the embryo are probably slight, and the pigment may therefore be in process of being stored in the chorionic villi against later needs.

If it is true that these granules originally had a fatty nucleus, it indicates that from a very early stage the syncytium is able to take up fat for the benefit of the embryo. That it does so in the formed placenta is, of course, a recognized fact. It is interesting to note that Eden mentions that he found fat in very occasional areas in the decidua and in the cytotrophoderm. This exact conformity with the distribution of the granules in my specimen is another argument in favour of the truth of Professor Lorrain Smith's view.

The cytotrophoderm is very similar in both specimens. The enlargement of the cells when they escape from the tips of the villi and spread out into the cell columns is most noticeable in the second specimen. It has also been recognized in several other ova.

The most interesting feature of the cytotrophoderm is the existence in the cell columns of empty spaces, presumably formed by the vacuolation of several adjacent cells (11). This is clearly visible in the first ovum, and it is possible to demonstrate that they do not communicate with the intervillous space. In the second ovum there are numerous smaller spaces entirely devoid of contents, which exactly resemble other spaces lying quite near but full of blood. The presence of these larger spaces in the one ovum, and the coexistence of spaces in the second, some containing blood, others empty, seem to argue strongly in favour of the view that the ramifications of the intervillous space are formed by the opening out of such spaces in the trophoderm. This view receives strong support from the conditions found in the Bryce-Teacher ovum, and these observers believe that the spaces are first formed by the accumulation in the cell columns of the trophodermic secretion. This ultimately finds its way to the surface of the trophoderm and in so doing opens out the spaces, into which the blood then penetrates.

Another very strong argument as to the truth of this view is to be found in the fact that exactly similar spaces may be seen in the trophoderm in the rat and mouse—some, as in my specimen, quite empty, others filled with maternal blood; and the only conceivable way in which the maternal blood could get into the spaces is by their opening out to the surface. This was pointed out by Professor Robinson some years ago, and I have actually seen several of his specimens which demonstrate the point.

The older view of Peters, that the spaces are formed by the outrush of maternal blood under pressure from the decidual vessels, after these had been opened into by the trophodermic activity, does not meet the observed conditions so satisfactorily.

The Embryonic Anlagen of the Intra-uterine Ovum.

It is most unfortunate that the rupture of the blastocyst and the consequent dislocation of its contents make it impossible to be certain as to the exact nature or arrangement of the two vesicles in this ovum. Before discussing the possible interpretations it may be well to enunciate the particular points that must be borne in mind in forming an opinion.

(1) (*a*) The first vesicle measures $0{\cdot}35 \times 0{\cdot}39 \times 0{\cdot}21$ mm.

(*b*) It consists of two layers, and at one point the outer layer is definitely continuous with the mesoderm of the blastocyst wall. The vesicle is thus quite clearly attached to the blastocyst wall.

(*c*) On one side of this rather triangular vesicle there is a distinct thickening, the cells being present in three or more irregular rows. The appearance at once suggests to the eye an embryonic area. The dimensions of this thickened area are $0{\cdot}21 \times 0{\cdot}2$ mm.

(2) (*a*) The second vesicle measures 0·26 × 0·28 × 0·14 mm.

(*b*) In structure it is a replica of the first vesicle.

(*c*) It is substantially attached to the blastocyst wall by the continuity of its outer layer with the blastocyst mesoderm at almost the farthest possible point from the first vesicle.

(*d*) At a level of about one-third of the way through this vesicle the cavity is almost completely filled up with cells, which form a floor, so to speak, dividing it into two parts.

(3) The attachments of the respective vesicles to the blastocyst wall are towards opposite ends of one side of that structure.

(4) The embryonic-area-like thickening is on the side of the first vesicle farthest removed from the second vesicle.

(5) Nowhere are the two vesicles in contact. Where they are most approximated to each other there is no trace of loose cells which might be regarded as the broken remains of an embryonic area between the vesicles.

Naturally the first endeavour is to translate the contents of the blastocyst as parts of a single normal embryo. In doing so several difficulties are met with. In the first place the two vesicles are entirely detached, and secondly there is no indication of any cells that might originally have formed a bond between them. Thirdly, both vesicles are attached to the blastocyst mesoderm at points considerably separated. Fourthly, both vesicles are identical in structure, and there is no suggestion in their structure as to which might be amnion and which yolk sac. Fifthly, while the whole ovum corresponds very closely in its general development and in the dimensions of the blastocyst to that of Jung, yet each individual vesicle is about the same size as the whole embryonic anlagen (amnion and yolk sac combined) in Jung's specimen. Jung's exact figure is 0·25 mm. measured by the number of sections through which the embryonic structures stretched. Later he points out that the yolk sac only stretches through twelve sections, each about 13 micromillimetres thick, giving for that vesicle a length of about 0·15 mm. The exact length of the two vesicles in the present ovum, as measured by the number of sections of known thickness, is 0·35 and 0·26 mm. respectively.

In regard to the first three difficulties it may be argued that the same applies to the Bryce-Teacher ovum. There the two vesicles are even more widely separated, without any trace of connection between them, and each is attached to the mesoderm. So far as it goes that is perfectly true, but that ovum was so young that one would hardly expect any very definitely formed embryonic area intervening between the two sacs, and the attachments to the mesoderm are of the most slender variety. Further, the Bryce-Teacher ovum represents a stage before the splitting of the mesenchyme to form the extra-embryonic cœlom, and therefore the attachments

may be partly accidental, due to the shrinkage and condensation of the mesenchyme in the hardening. The present ovum on the other hand represents a stage after the formation of the extra-embryonic cœlom, and in spite of that both vesicles have definite attachments to the mesoderm.

In regard to the fourth difficulty, it must be remembered that in Peters' and Jung's ova there is a definite differentiation of the cells at the base of the amnion,indicative of the formation of the embryonic ectoderm. The only situation in which there is anything similar in my ovum is the thickening on the wall of the first vesicle at the side most remote from the second sac.

One other possible view in regard to the attachment of both vesicles is that one attachment represents an amniotic duct. This is a duct or cord of cells connecting the amniotic cavity with the outer surface of the chorion. Eternod, Marchand, and Beneke, have described what they believe to be indications of it in human ova, and Selenka has described it in the ova of apes. According to Keibel it is very doubtful if it is at all a regular condition in the human ovum. Probably not, for it is but "a phylogenetic memory from dim ancestral times." In specimens such as Marchand's there is a depression on the surface of the chorion at the end of this duct. In the case of the second vesicle in my specimen there is no depression, and nothing to support such a view. In regard to the first vesicle I cannot speak so definitely as the chorion has been ruptured in the immediate neighbourhood of the attachment of the sac. But so far as I can see there is no suggestion of a depression. In any case, even if the first sac was clearly proved to be amnion, there still remain the other difficulties in the way of co-ordinating the two sacs as parts of one single embryo.

Failure to interpret the vesicles satisfactorily as parts of a single embryo compelled one to study them as the possible components of a twin ovum. This interpretation involves three assumptions. The first is that the thickening on the wall of the first vesicle is an embryonic area. The second is that on the other side of it there was another sac—probably the yolk sac—which has been broken up and dispersed. In Fig. 18 there is shown a strand of cells stretching out towards the second vesicle, which, if curled round the opposite way, might be imagined to have formed a closed sac superficial to the thickened area.

The third assumption is that the cells, filling up the cavity of the second vesicle through the thickness of several sections, do really form a floor, and represent the embryonic area of the second embryo. In this event the area must have been cut on the flat, and that part of the vesicle superficial to it would represent the yolk sac, while the part beneath the embryonic area would represent the

amnion. This interpretation would bring the second embryo into very close correspondence with the dimensions of Jung's embryo.

In connection with this view the investigation of the specimen gave a useful example of the value of studying such a specimen, not only by serial sections, but also when possible by means of a model reconstruction (31). For the construction of a wax model on a scale of 1 :200 of the two vesicles and the side of the blastocyst to which they are attached, I am greatly indebted to Professor Robinson, who personally made nearly two hundred drawings with the camera lucida, and reconstructed the model. One of the special points that the model cleared up was in connection with a fold or pocket of the first vesicle at the base of the thickened area. The study of some isolated sections, in which this fold appears as a separate vesicle on the surface of the thickened area, would have led us to regard the fold unhesitatingly as the yolk sac of a first embryo, and would have rendered the interpretation of the specimen as one of uniovular twins perfectly clear and free from any objection. By studying serial sections, however, and still more by the construction of a model in three dimensions it became obvious that this pocket or fold was directly continuous with the rest of the vesicle. We were thus led to avoid a somewhat tempting error! In other respects the model fully confirmed our previously formed views as to the relations and shapes of the vesicles and the fact that they do not touch at any point.

The conclusion of the whole question is, I believe, that it is impossible to determine with any approach to certainty in favour of either the one interpretation or the other. The specimen may be one of a single embryo, with or without an amniotic duct, whose component parts have been seriously dislocated by mechanical influences, probably during the removal of the uterus from the body. On the other hand it may be a specimen of uniovular twins at a very early stage of development, the yolk sac (?) of the first embryo being broken up and dispersed. The arguments on either side seem to be fairly well balanced. The decision of any individual observer must remain merely an opinion.

The Age of the two Ova.

In neither case have I been able to get any history that would help in determining the age of the ovum. In the first case the husband did not know the date of the last period, although he was quite sure that no period had been missed. Before I could interrogate him more closely he had left the city. In the case of the second specimen, the patient had forgotten the exact dates by the time I came to investigate the question in detail. All she knew was that the last period had been "about three weeks before the operation."

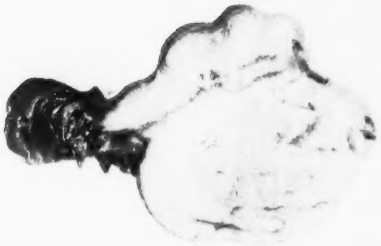


FIG. 30.—Ovary and tube with infundibular pregnancy.

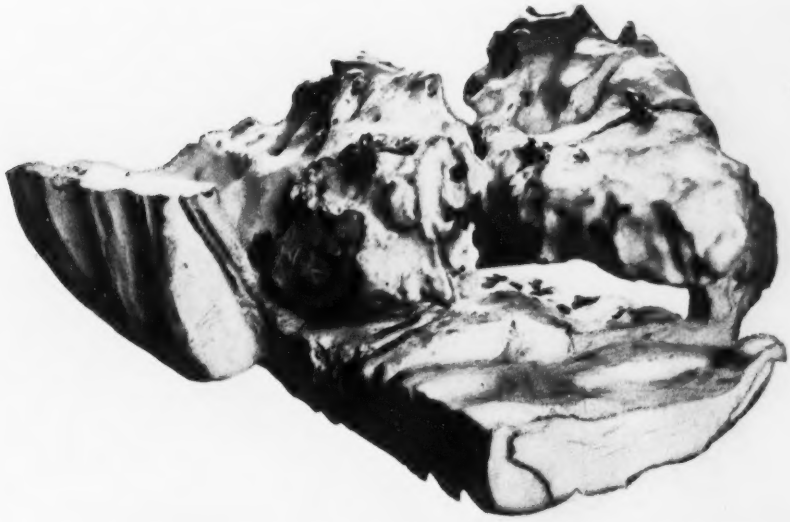


FIG. 31.—Wax reconstruction model (1-100) of the embryonic vesicles and their attachment to the blastocyst wall. The vesicles do not touch at any point.

Any estimation of the age must therefore be made by the rather tentative method of comparison with other specimens. The first specimen corresponds closely to Jung's in its dimensions, and in the development of the villi. That ovum, according to the table of Bryce and Teacher, whose reckoning I regard as more accurate than that of His in spite of such cases as Giacomini's "eleven days'" ovum, was probably about $14\frac{1}{2}$ to $15\frac{1}{2}$ days old. I would therefore place the age of my first specimen at about 15 days.

I have figured and described the corpus luteum, for, as Mall points out, no record of an ovum is complete without it, if it is available. In size and development it corresponds fairly closely to the description of the corpus luteum in the second week given by Leopold and Ravano. So far as it goes, therefore, the corpus luteum supports this estimate of the age of the ovum, but I do not think that we are as yet in possession of anything like an accurate standard of the development of that strange organ, and I do not place much importance upon it.

The blastocyst of the second specimen measures $2{\cdot}73 \times 6 \times 5{\cdot}6$ mm. The embryonic area proper measures 1·6 mm. The blastocyst therefore corresponds to the specimens of Rossi Doria and Eternod, which Bryce and Teacher place at 18 to 19 days old. The embryo in regard to development lies between "Gle" of von Spee and "Klb" of Kroemer and Pfannenstiel. The former is regarded by Bryce and Teacher as 19 to 20 days old. I think therefore that the second ovum was probably about twenty days old.

In conclusion it is a great pleasure to express my thanks to Professor Harvey Littlejohn and Dr. William Fordyce from whom the respective specimens were obtained, and to Dr. Barbour for permission to investigate the first ovum. Professor Arthur Robinson has allowed me to draw freely on his experience and knowledge, and, as stated, personally gave much time to the reconstruction of the model. For all this help, so willingly given, I offer him my heartiest thanks. I am indebted to the Earl of Moray Endowment of the University for a contribution to the expenses of the research.

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Treatment of Retro-Displacement of the Uterus.*

By Ralph Worrall, M.D., M.Ch.

Gynæcologist to the Sydney Hospital.

Before approaching the question of treatment it would be well to ask if retro-displacements always cause symptoms which necessitate treatment? The answer in my experience should be that as a rule sooner or later symptoms occur. These are menstrual disturbances, abnormal discharge, pains and aches, sterility. I am aware this opinion does not agree with that of Herman and most other English writers, but "I give you the tale as it has been told to me."

Next—what are the causes which produce retro-displacement? One must have a clear conception of these in order to apply treatment intelligently.

The most common are those arising from conception which has ended in an abnormal manner, and thus led to the injury and subinvolution of those structures which maintain the pelvic organs in position.

The next most frequent is improper mode of living, especially during the developmental period of life. At this time exercise associated with full rectum and bladder strongly tends to produce displacement, as do also excessive mental efforts, which impair health and divert vital energies required for the vigorous development of the genital system to another and less important purpose.

Coming now to the all-important question of *treatment*, it is evident from the frequency and warmth of the discussion on the subject throughout the world that this is far from settled .

Purely Hygienic.

Manipulative (Massage).

Mechanical (Pessary).

Operative (in which the procedures recommended are many and various) all have strenuous advocates.

Hygiene is always wise, and when there are no symptoms should be the treatment of choice.

Pelvic massage has fortunately few followers.

Pessary treatment is still largely used, and does incalculable harm. Everyone who has studied the bacteriology of the vagina and realised how readily the normal flora become pathogenic must admit this. Pessaries necessarily produce stasis of the vaginal and uterine secretions, and stasis inevitably leads to infection. This is seen in all the excretory canals throughout the body—tear ducts,

* Being the opening of the discussion on this subject at the Australian Medical Congress in Auckland, New Zealand, February 11, 1914.

biliary ducts, urethral canal, intestinal canal, genital canal. It is far better to do nothing than adopt a treatment which interferes with nature; wherefore I think the pessary treatment should be discarded.

Operative Treatment.—I have looked through my records for the past five years, and find that during that time I have done *the Webster-Baldy operation* of passing the round ligaments through the broad ligaments and suturing them behind the uterus ten times with no mortality and one failure. It seems to me this procedure obstructs the broad ligament veins, but I am not disposed to condemn it without a larger experience.

The Original Alexander's Operation.—Seventy-two times with no mortality and seven failures or relapses. I find I am gradually doing this operation less frequently, although I still consider it is the best operation for uncomplicated retrodisplacement in young or middle-aged women. In the old or emaciated, or those in whom there has been procidentia for a long time, the round ligaments become so attenuated as to be of little value; also, I so often recognize probable appendicitis or indication of salpingitis, shortening of the broad ligaments, or abnormal size of the uterus that the tendency is to decide in favour of an intraperitoneal operation.

Five times I have done *abdominal section* plus *Alexander's operation* by making a "T" incision of the medium incision, thus reaching the external abdominal rings. These cases did well. One could note the exact effects of shortening the round ligaments in the position of the uterus. The extra time is against this procedure, and also the feeling that when the peritoneal cavity is open it is better to adopt the method that gives the most certain results.

I have never known Alexander's operation to cause the slightest trouble during pregnancy or labour except in one case operated on by another surgeon in which there was great pain in the inguinal canals during the pregnancy, necessitating the induction of labour in the seventh month. I think the ilio-inguinal or genito-crural nerves must have been included in the non-absorbable sutures. Why Alexander's operation occasionally fails, even when done in apparently suitable cases, I am unable to determine.

There have been 334 ventrosuspensions in the five years; of these 191 were primary and 143 secondary—that is, 143 were done in the course of an operation for some other condition, and the other primarily for retroversion associated with one or other of the conditions which I have mentioned above as excluding Alexander's operation.

The mortality was nil in the primary and one in the secondary. There were five relapses at an early date apart from pregnancy and three after labour. On the other hand, in six cases the uterus was found to be normal in position a variable period after labour. Preg-

nancy and labour at term occurred eleven times without unusual trouble of any kind. Abdominal section was required subsequently to ventrosuspension in thirteen cases as follows:—

For *Ectopic Gestation*, band 1½ inches long.
Myoma, band 4 inches long.
Acute Gonorrhœal Salpingitis, band 2½ inches long.
Acute Salpingitis, band 1 inch long.
Ectopic Gestation, after normal pregnancy had occurred; uterus normal in position, no trace of band.
Retroversion after two operations for the same at other hospitals; band like a piece of twine, 6 inches long from posterior surface at level of inner os.
Adeno-myoma diffusum, band 1½ inches long.
Adeno-myoma diffusum, band 1½ inches long.
Appendicitis, band 2 inches long.
Retroversion, for recurrence, no band.
Appendicitis, band 1½ inches long.
Oöphoro-Salpingitis, band 2 inches long.
Appendicitis and adhesion of sigmoid to stump of left tube removed at previous operation, band 2 inches long.

In no case did these bands exceed half an inch in width; most were less than this.

I have heard of two other cases in which my colleagues operated for relapses subsequently to labour, the original operations having been performed by me, in which there were long useless bands.

I wish to emphasise that all the above figures refer only to cases which have come under my notice, and that it has been quite impossible for me to have discovered the subsequent history of the cases as a whole.

I have never seen or heard of any ventrosuspension done by myself giving rise to either dystocia or intestinal obstruction. One patient was sent into the Sydney Hospital with the diagnosis of obstruction due to ventrosuspension. Operation showed that the obstruction was due to a Meckel's diverticulum, and in no way connected with the ventrosuspension band.

The procedures grouped under the term *ventrosuspension* are so many and so varied that it conveys no exact meaning without full details of the technique.

On the one hand you have a surgeon, as in one of the above-mentioned cases, seeking to unite the posterior surface of the uterus at the level of the inner os to the parietes. While others avoid the posterior surface and obliterate completely the utero-vesical space by uniting the whole of the anterior surface of the uterus to the serosa of the bladder and parietes.

Each dubs his method ventrosuspension, although in the latter of these methods the uterus is really fixed by its anterior surface.

In the discussion on the treatment of malpositions of the uterus, at the last meeting of the B.M.A. at Brighton, Dr. Mary Scharlieb opened the discussion, and described her technique as " passing three silk worm-gut sutures through fascia and peritoneum on one side, then through the musculature of the uterus as low down as possible on its anterior surface, then through fascia and peritoneum on the other side " (it would be interesting to follow the subsequent history of these buried, non-absorbable sutures in close contact with the bladder). She says: " I have never placed the suture in the fundus itself, still less have I invaded its posterior aspect."

Drs. Giles, Martin, and Cuthbert Lockyer agreed with the technique, and all expressed belief in pessaries. Mrs. Scharlieb in her reply said: " It could not be too strenuously insisted upon that no fixation sutures should be passed in the fundus or posterior wall of the uterus."

I say the exact opposite. It cannot be too strongly insisted upon that no suture, and especially no non-absorbable suture should be passed through the anterior wall of the uterus.

My reasons are that the uterus has no normal fixed *position*, but a normal *range of movement*. Sutures of silk worm gut passed as described by Mrs. Scharlieb must necessarily fix the uterus. Secondly, sutures passed through the anterior wall must necessarily throw the uterus backwards to some extent, and thus invite intra-abdominal pressure to exert its force on the anterior instead of the posterior surface, as intended by nature.

The purpose of the various ligaments, round, broad, and utero-sacral, is, conjointly with the pelvic floor, to utilise the greatest, and what one would imagine to be the most disturbing force—intra-abdominal pressure—as the chief means of maintaining equilibrium. These ligaments—guy ropes, as they have been called—ensure that the posterior surface of the uterus shall be exposed to intra-abdominal pressure, so that the greater the effort the more certainly is the uterus pressed forward against the pubes, while at the same time the pelvic floor, acting synchronously with abdominal strain by pulling the posterior segment of the floor forwards against the anterior, deflects the force in a harmless direction.

If these views are correct, we should avoid any method by which the anterior uterine surface is exposed to intra-abdominal pressure, and Mrs. Scharlieb and her supporters must be held to be wrong.

The object to be attained is to restore the integrity of the damaged guy ropes by Alexander's or similar operation, or, if it seems best, to create a new guy rope by the ventrosuspension technique, which I shall describe, while at the same time, if necessary, the pelvic floor is reconstituted so that it can carry out its important function.

The technique adopted in all the cases to which I have referred is as follows:—

The fundus uteri is seized with volsellum forceps in the centre, about one line behind the level of insertion of the tubes; a round, curved needle, with No. 3 ordinary catgut, is passed through the fascia and peritoneum of one side the musculature of the uterus at the point gripped by volsellum and peritoneum and fascia of the opposite side. A similar suture is passed about quarter to half an inch posterior to this. The serosa of the quarter square inch, just behind the summit of the uterus included in these two sutures is then carefully abraded, and, by tying the two sutures, brought in contact with a similar abraded raw area on the parietal peritoneum.

This operation is easy, safe, and gives a symptomatic anatomical and physiological cure in 90 per cent. of cases; that it does this, and also that it in no way interferes with pregnancy or labour, I think my cases fairly prove. True, the guy rope is either destroyed or rendered useless by pregnancy, but if all has been normal in the puerperium nature's apparatus will probably have been restored, and there will be no need for further help, as has been clearly shown in several of my cases. However, in order to meet this drawback to a ventrosuspension operation, I have for the past year accepted the suggestion of Murphy, of Chicago, and drawn the round ligaments over and sutured them behind the tubes at the posterior surface of the uterine cornu before tying the ventrosuspension sutures, thus giving a reinforcement to the latter capable of evoluting and involuting.

In the *A.M. Gazette* for January 24th there is an able résumé of "The Effects on Labour of Ventrofixation," by Dr. S. Harry Harris, of Sydney, who adds two cases of his own in which dystocia occurred after ventrofixation and Gilliam's operation respectively. Dr. Harris refers to a number of reported cases in which serious consequences at labour followed the operation, but, as I said before, I restrict my remarks to my own experience, of which I give you an unvarnished tale. It is evident that in many of the cases collected by Dr. Harris suppuration occurred, and of the others we do not know the exact technique adopted.

REVIEWS OF CURRENT LITERATURE.

UNDER CHARGE OF EARDLEY HOLLAND, M.D.

Surgery, Gynæcology and Obstetrics.

xviii, 1, *January*, 1914.

1. *The relationship between the urinary system and diseases of the female pelvic organs. J. CLARK and F. KEEN.
2. *The diagnosis and treatment of border-line pathological lesions. J. C. BLOODGOOD.
3. *The post-operative results of trachelorrhaphy in comparison with those of amputation of the cervix. V. LEONARD.
4. Cysts of the Omentum; with a report of a case. V. FUNK.
5. An artificial ureter made from the Abdominal wall. ALFRED STRAUSS.
6. A new diagnostic sign in injuries of the abdominal viscera. E. CLAYBROOK.
7. The surgical treatment of bacillus coli communis infections complicating pregnancy. EDWARD P. DAVIES.
8. *A note on the recognition of the ureter; report of a case of anastomosis of the ureter into the appendix. WAYNE BABCOCK.

The relationship between the urinary system and disease of the female pelvic organs. J. G. Clark and F. E. Keen. The aim of this article is to point out the similarity between the symptoms of disease of the genital and urinary tracts, and to urge the more frequent use of the cystoscope by gynæcologists. A few cases and diagrams are given to illustrate some of the possible mistakes in diagnosis which could be made.

The diagnosis and treatment of borderline pathological lesions. Joseph Bloodgood believes that all connective tissue tumours are better excised entire rather than enucleated if there is any question of their malignancy.

The post-operative results of trachelorrhaphy in comparison with those of amputation of the cervix. V. Leonard. From the careful consideration of a large number of cases the author concludes that trachelorrhaphy is very efficient in properly selected cases. It is contra-indicated if there is endocervicitis, when the cervix should be amputated. The incidence of abortion and premature delivery is greatly increased after amputation and hence the operation of choice for women in the child-bearing period is trachelorrhaphy. More or less severe post-operative hæmorrhage follows amputation of the cervix in 5 per cent. of cases, but this is very rare after trachelorrhaphy.

A note on the recognition of the ureter; report of a case of anastomosis of the ureter into the appendix. Wayne Babcock has noticed that peristaltic waves can be seen in the ureter as it runs under the peritoneum. The author implanted the right ureter into the appendix and the left into the rectum in a case of advanced carcinoma of the bladder. The patient died two days later.

xviii, 2, *February*, 1914.

1. Neoplasms of the renal pelvis; with especial reference to the transplantation in the ureter and bladder. W. E. LOWER.
2. *The heart in fibroid tumours of the uterus. J. MCGLINN.

3. *A study of the comparative value of functional tests in the surgical diseases of the kidney secondary to obstruction in the lower urinary tract. L. G. Rowntree, J. T. Geraghty, and E. K. Marshall.
4. *Indirect transfusion of blood. Andre Crotti.
5. *The extraperitoneal Cæsarean section. Its place in obstetrics. William Nicholson.
6. Some causes of failure in bacterin therapy. J. F. Biehn.

The heart in fibroid tumours of the uterus. John McGlinn. The belief in a casual relationship between myomata of the uterus and cardiac disease is based upon :—(1) the frequent association of functional and organic heart lesions with these tumours; (2) the deaths both before and after operation attributable only to heart failure; (3) the study of comparatively few post-mortem records of such deaths. The forms of heart disease usually described as being caused by myomata of the uterus are hypertrophy and dilatation, myocarditis and valvular disease. In order to throw light on this question the author has compared the autopsy records of 244 cases in which myomata were found, with the same number of cases of a similar age and race which had no such tumours. The methods which the author has used in collecting and comparing the cases appear to be such as will give a fair and accurate conception of the true state of affairs.

Only two, out of some fifteen theories which have been advanced to explain the causal relationship between fibroids and heart disease, are applicable to all cases and are therefore worth considering. These are :—(1) that the tumour in its growth produces a toxin which affects the heart; (2) that the myoma is only a local manifestation of a general condition. Under both theories, however, some proportional relationship must surely exist between the size of the tumour and the grade of heart lesion, but the author clearly shows that no such relationship exists.

The conclusions which McGlinn arrives at after a detailed statistical review of his data may be summarised as follows :

(1) That a definite entity of a " fibroid heart " cannot be sustained.

(2) That although myomata of the uterus and sclerotic heart lesions are commonly found in association in middle and advanced life, the latter are part of a general condition and bear no relationship to the presence of the tumour.

(3 That the anæmia degenerations of myomata may have a secondary effect on the heart causing cloudy swelling, fatty degeneration or brown atrophy, but in the majority of such cases the degenerative changes are originated by conditions entirely foreign to the myomata.

A study of the comparative value of functional tests in the surgical diseases of the kidney secondary to obstruction in the lower urinary tract. L. Rowntree, J. T. Geraghty and E. K. Marshall. The authors summarise their views of the different tests by saying that " to detect the functional impairment associated with the renal changes consequent upon obstruction in the lower urinary tract, the phthalein affords an indispensable index to the true renal condition. Nothing beyond corroborative evidence is to be obtained from the employment of other functional tests."

Indirect transfusion of blood. Andre Crotti. The author has found that if a glass syringe is boiled in normal saline coagulation of blood in it is delayed for about eight minutes. He points out that this fact enables direct transfusion of blood to be carried out both simply and quickly. He has used this method in two cases, one of which died.

The extraperitoneal Cæsarean section. William Nicholson, after a critical review of the different methods of performing extraperitoneal Cæsarean section and the indications for the operation, concludes that the suprasymphyseal route is useful in clean or mildly infected cases, but contra-indicated in those which are seriously infected. The operation is more difficult than the classical operation but there is less blood lost. The Veit-Fromme transperitoneal technique is to be preferred to the true extraperitoneal because it is easier, interferes less with the bladder, and avoids contamination of the retroperitoneal tissues. Subsequent pregnancy and labour are not influenced adversely, but the repetition of the procedure may be more difficult or, in some cases, impossible.

W. W. KING.

Archives Mensuelles d'Obstétrique et de Gynécologie.

December, 1913.

1. On two successful cases of transfusion of blood in two newly delivered women with infection and profound anæmia after post-partum hæmorrhage. JEANRIN and ROUX-BERGER.
2. *Prolapse of the umbilical cord. RUTH JOHANSSON.
3. *The effects of X-rays on ovary. LEVANT.
4. Discussion in the Chambre des députés on the law of rest for lying in women. LEVANT.

Prolapse of the umbilical cord. In the wards of the clinique at Lund under Essen-Möller from 1900 to 1912 there were 35 cases of prolapse in 7518 deliveries, that is 1 in 215. These cases are related briefly as well as one from Professor Essen-Möller's private practice.

As regards etiology it is noted that at least 20 per cent of the cases occurred in flat contracted pelves, but as internal pelvimetry was not systematically carried out the figures cannot be taken absolutely. The relative frequency in multiparæ is double that in primiparæ. The fœtuses were mostly very large or very small. Prolapse occurred more frequently in abnormal presentations and where limbs prolapsed in front of the head: twin births seem also a predisposing cause. Liquor amnii is reported as abundant in about 18 per cent. of the cases, and in some of the cases observed the prolapse occurred at the time of rupture (artificial or natural) of the membranes. In general the cord was longer than the average. Placenta prævia with version, and marginal attachment of the cord are noted once each. In four cases the cord was looped round the child.

Two of the patients were admitted with dead children. The rest of the cases were tabulated according to results of treatment along with those of other reporters. Essen-Möller's own cases were as follows:

	Living children.	Dead children.	Mortality.
Version	7	1	14·3
Retropulsion	—	—	—
Forceps	7	2	28·6
Version in shoulder presentations	3	2	66·6
Footling deliveries	11	3	27·2

The prognosis is naturally worse where the prolapse occurs early in labour and where from any cause rapid delivery is impossible. Expectant treatment is bad, and Dr. Johansson recommends in head presentations with undilated os the incision of the cervix and delivery by forceps where this can be done without risk to the mother.

The effect of X-rays on the ovaries. This work is from the thesis of Lacassagne of Lyons 1912-1913. The observations were made on rabbits with single doses of hard, filtered X-rays up to tint iv of Bordier's radiochromometre. Sometimes the radiation was unilateral so as to use the sound ovary as a check. Examination at various dates showed that the degeneration begins a few hours after irradiation and is completed in about fifteen days with disappearance of the follicles. In spite of this sterilization is rarely complete, for follicles in their primary stage remain. During a second stage, from the second to the third month the interstitial gland regresses and the epithelium becomes calical then flattened, resembling an endothelium.

After the fifth month there is some amount of recovery: a new interstitial gland arises: the follicles begin to grow from the sixth month with the epithelium becoming cylindrical. This does not always occur and there is no reserve of follicles, so the animal's sexual life is shortened and some animals are permanently sterilized: but to ensure sterilization the dose of irradiation must be so large as to risk the life of the animal. Photographs are given of the various stages in the interstitial gland and follicles.

It is concluded that it is impossible to sterilize a woman by X-rays: the effects on fibroids are due to the destruction of the corpora lutea and to direct action on the fibroid.

February, 1914.

1. *Nine cases of human ovarian autografts. De Rouville.
2. *Tubal pregnancy associated with atypical evolution of the corpus luteum. Schil.
3. Mathias Saxtorph and his contemporaries. Hauch from Ingerslev.

Nine observations on ovarian autografts in women. De Rouville, Montpellier, records his experience in nine women in whom he implanted grafts of ovarian tissue removed from their own bodies by operation. He is somewhat optimistic, though he confesses frankly that only one woman—from the clinical standpoint—received any benefit: other operators have done better than himself.

In all the cases the portion of ovary was embedded under the skin of the abdominal wound, as this permits of easy access for observation or for removal should this be found necessary. The results of the grafting can be controlled in three different ways; by direct examination of the ovary in situ: by observing the re-establishment of its functions and by microscopical examination of the graft. To carry out the direct examination satisfactorily, the graft must be under the abdominal skin, when its changes of volume—gradual or periodic—are visible and palpable; but it must be noted that an ovary which has apparently retained its normal size may be completely atrophic and consist of only fibrous tissue. The observation of function is of great interest; when not atrophied the ovary swells usually from five to twelve days before the onset of the period and is painful and tender: it is possible to doubt that the grafted ovary, after a bilateral oophorectomy, really keeps up menstruation, for we know that pregnancy has followed such an operation even when grafting was not performed: but even if menstrual functions are maintained they may be so in an irregular and troublesome fashion, with metrorrhagia, dysmenorrhœa and so on. Such hæmorrhages are comparable with those set up by uterine fibroids, and cease when the ovary has been removed. The microscopic examination of the ovary was made only once and the ovary though still living and maintaining menstruation was obviously in process of degeneration. The

woman No. 1, received no benefit but was not inconvenienced: No. 2, received no benefit and was inconvenienced by the painful periodic swellings: No. 3 was decidedly benefited: No. 4 would have been better without grafting: No. 5 suffered from perverted internal secretion (due to degeneration of the corpus luteum) causing hæmorrhage, which ceased on removal of the ovary: No. 6, received no benefit: No. 7 progressed just as if no graft had been made: No. 8, received a very temporary benefit and the rapid atrophy of the ovary makes it doubtful if any benefit really accrued from the presence of the ovary: No. 9 showed only negative evidence, but the ovary was infected and should not have been grafted.

Rouville concludes that more observations are required to enable indications to be laid down as to cases and conditions favourable to the performance of this operation successfully.

Tubal pregnancy associated with atypical evolution of the corpus luteum. Schil, working with Professor Bar in the clinque Tarnier, was examining a series of ovaries and was struck by the observation that the abnormal corpora lutea came from women who had suffered from tubal pregnancy: conversely, of six tubal pregnancies four shewed cystic degeneration of the corpus luteum and the remaining two shewed sclerosed ovaries (the operations were unilateral) with no trace of corpus luteum. Ten years ago Frænkel had already suggested a causal connection between the two conditions and had been supported by others.

Schil concludes from his observations that the causation of the tubal pregnancy is the absence of peristalsis in the tube during the passage of the ovum. The determining factor accordingly is the same as that which causes the cessation of peristalsis, but as this peristalsis is due to one of two conditions, either some affection—such as cyst formation, which modifies the physiological activity of the corpus luteum, or extra-ovarian factors which are capable of inhibiting the action of the internal secretion of the corpus luteum.

In the first two ovaries examined the corpus luteum was found to contain no blood clot but a fibrinous fluid distending it in a cyst-like manner and causing atrophy of the peripheral tissues. The third case showed a layer of connective tissue lining the interior of the cyst inside the lutein cells. The fourth case was a more completely formed cyst lined apparently by endothelial cells. Schil discusses the normal and the atypical evolution of the corpus luteum and also the modifications of the tubal epithelium under the influence of the corpus luteum of pregnancy: in particular he draws attention to the observation of Moreaux that the absence of ciliated epithelium at the time of the dehiscence of the ovary and at the beginning of pregnancy prevents our attributing the passage of the ovum to the action of cilia. Three micro-photographs are given.

E. H. L. Oliphant.

La Gynécologie.

January, 1914.

1. Treatment of abnormal openings of the rectum: with 10 plates. Marquis.
2. Cornual pregnancy (grossesse angulaire). Devraigne.
3. Abderhalden's reaction in the diagnosis of pregnancy. Block-Vormser. Review of literature with bibliography. E. H. L. Oliphant.

Revue de Gynécologie et de Chirurgie Abdominale.

February, 1914.

1. *On hysteropexy and the technique of Doleris' operation. GEORGES ROUHIER.
2. *Aberrant and distant fibroids of uterine origin. M. GOULLIOUD.

Hysteropexy and the position of choice for bringing the round ligaments through the abdominal wall in Doleris' operation. The writer again draws attention to the dangers of suspending the fundus or anterior wall of the uterus to the parietal peritoneum. He points out that any operation which does not allow of subsequent pregnancy without danger to the mother must be abandoned, as one of the great uses of hysteropexy is to obtain a full time infant in cases where retroversion of the uterus has been a cause of sterility or abortion. He favours the use of the round ligaments but agrees that occasionally in multiparæ they may be very feeble structures and not sufficiently strong to suspend the uterus. This is however very rare. He discusses the various methods in use and quotes Gosset that the method of choice must be one that freely opens the peritoneal cavity and allows of a full inspection of the appendages and the presence or absence of adhesions. The method which he advocates, as the result of a small series of cases which he has operated on, is one ascribed to Doleris. By this method the uterus is suspended by its round ligaments which are brought through the interval which, he says, can always be found between the muscles coming from the two heads of origin of the rectus abdominis. This space can be found by the presence of a fatty layer separating the two muscular strands. The round ligaments are then stitched together in the middle line. An advantage possessed by this position is the absence of any risk of wounding the inferior epigastric artery which lies quite outside the spot where the round ligaments perforate the abdominal wall. The anterior sheath of the rectus is stitched together over the united round ligaments. A Pfannenstiel incision is advised.

Aberrant uterine fibroids. Goullioud devotes twelve pages to this subject. Uterine fibroids can become separated from their uterine attachments in two ways: (*a*) by torsion of their pedicle when they may get free inside the peritoneal cavity and contract adhesions to the intestine or omentum; (*b*) by the continuous growth of an intra-ligamentary fibroid away from the uterus. In these cases the tumour is extra-peritoneal and they are termed by Goullioud "distant fibroids."

He gives details of two cases. In the first an old maid of 65 had symptoms of intestinal obstruction. At the operation a small fibroid was found behind the mesentery of a coil of intestine at about the level of the umbilicus. A second tumour was found behind the peritoneum in the right iliac fossa; a third was in the broad ligament. The uterus contained many fibroids and was removed by sub-total hysterectomy. The three "distant" fibroids were removed and also about a yard of intestine which was damaged in enucleating one of the tumours. Sections showed them all to be fibroids, some had undergone calcification. The patient was alive and well nearly four years later.

His second case which he publishes as an example of an "aberrant" fibroid was that of a woman aged 39 who had a hysterectomy for fibroids performed. At the end of the operation a mass was felt between the small gut and the sigmoid. This was enucleated and proved to be a fibroid which had become entirely free from the uterus and was only nourished by the vascular cohesions which surrounded it. The "aberrant" tumour weighed 175 grammes. Sections proved it to be a fibroid. CLIFFORD WHITE.

Monatsschrift für Geburtshülfe und Gynäkologie.

xxxix, 3, *March*, 1914.

1. Gynæcology and Psychiatry. SIEMERLING.
2. *The effect of radium and mesothorium on carcinoma of the cervix. LAHM.
3. *The etiology and treatment of uterine hæmorrhage. SCHICKELE.
4. Results with intravenous injection of Arthigon in gonorrhœa in the female. Moos.
5. Congenital recto-urethral fistula. KREIS.

The effect of radium and mesothorium on carcinoma of the cervix. The author reports the microscopical findings of a case of inoperable carcinoma of the cervix treated with the above rays. Contrary to Döderlein's views the normal cervical glands are slightly affected, the epithelium is spread out more, the cells are longer, there is a slight vacuolation and increase in size of the nucleus and the boundary between the cell and stroma is not clear. The malignant cells at first become signet ring shaped with the nucleus smaller than normal. Later on the nucleus becomes much larger and again this lies in the centre of the cell, which now has a foamy appearance. Between these greatly distended cells are polymorphs, masses of exudation, and a highly characteristic proliferation of the lymph vessels. The polymorphs increase in number and invade the cells. The nucleus is broken up and disappears. Finally there remains a mass of degenerated material but no formation of normal cervical tissue.

The first effect of the rays causes a marked hyperæmia and serous infiltration of the connective tissue comparable to the first stage of a burn. Clinically the vaginal discharge becomes lessened and serous in character. This transudative stage is followed by one of exudation and this by phagocytosis. Apart from the increased vascularity and the proliferation of the lymph vessels, the connective tissue plays only a passive role—this is contrary to Döderlein's view.

The malignant cells are rich in lecithin and this is broken up by rays into cholin and free OH. These substances react on the leucocytes causing them to attack and remove the tumour cells. In cases of marked cachexia the reaction of the leucocytes is very poor but may be increased by the injection of blood serum. Lahm advocates small doses of mesothorium and radium combined with these injections in all cases of marked metastases and cachexia. The article is illustrated with several micro-photographs.

The etiology and treatment of uterine hæmorrhage. This critical review deals with the theories regarding menstruation, the causes of menorrhagia in young girls and in women and the various methods of treating these conditions. All the possible causes are very fully discussed in the paper.

R. M. ALLAN.

Gynækologische Rundschau.

Heft 3, 1914.

1. *Etiology and diagnosis of Hyperemesis Gravidarum. L. STOLPER.
2. *Physiology, Dietetics and Pathology of the puerperium. K. HEIL.

Etiology and diagnosis of Hyperemesis Gravidarum. The author reviews the theories which have been advanced regarding this condition. He concludes that it is due to a toxin circulating in the blood. The method of its action is not quite clear. The liver, corpus luteum, interstitial cells of the ovary and the placenta may be implicated. It is probable it is not primarily due to a hepatic insufficiency but to a poisoning of some of the glands of internal secretion. A point of diagnostic importance is the disturbance of the power of the body to assimilate sugar.

REPORTS OF SOCIETIES.

ROYAL SOCIETY OF MEDICINE.
SECTION OF OBSTETRICS AND GYNÆCOLOGY.

Meeting held at the Society's House, Thursday, March 5th, 1914.

Dr. W. S. A. GRIFFITH in the Chair.

Dr. J. BRAXTON HICKS showed for Dr. T. G. Stevens a specimen of DECIDUAL CAST FROM THE UNIMPREGNATED HORN OF A DI-DELPHIC UTERUS.

The clinical notes of this case were read at the meeting of this section on February 5th, 1914. The specimen was the decidual cast passed by the patient during the puerperium, and came from the unimpregnated horn. It measured 8 c.m. by 6.5 c.m., and was 1.5 c.m. thick in parts. It presented the ordinary appearances of a cast such as might be met with in a case of ectopic gestation but was much larger. Microscopically, it consisted of fine connective tissue, in which were decidual and interglandular cells and the remains of uterine glands. Most of the cells present showed more or less degeneration.

Dr. CUTHBERT LOCKYER showed a case of

MULTIPLE FIBROIDS REMOVED DURING THE SIXTH MONTH OF PREGNANCY,

in which spontaneous labour occurred at term, followed by a normal puerperium. As the patient was 41 years of age and had never been pregnant, the diagnosis of pregnancy was not at first seriously entertained, and treatment for a reddish-brown discharge was carried out for three months in the out-department of Charing Cross Hospital. The periods had been regular and scanty until May, 1913. In June no period occurred, but instead of this a brown discharge appeared, and gradually dysuria, frequency of micturition, and obstinate constipation set in. In October, 1913, there was a fibroid impacted in the pelvis, elevating the cervix so that the external os was at the level of the upper limit of the symphysis pubis, and there was an elastic swelling reaching for three fingers' breadth above the umbilicus. There was secretion in the breasts. The diagnosis of pregnancy complicated by urgent symptoms due to an impacted pelvic tumour was made. On October 24th a fibroid the size of a fœtal head was enucleated from the lower uterine segment, and one the size of a tangerine orange was removed from the back of the uterus higher up. A smooth convalescence followed, and after four months' comparative comfort a healthy female child was born in the Golding Ward at Charing Cross Hospital. The labour and puerperum were normal. The abdominal scar remained perfect, and the patient, although an elderly primipara, was able to nurse her child.

The PRESIDENT, Dr. WALTER TATE, Dr. GILES, and Mrs. SCHARLIEB discussed the case.

Mr. VICTOR BONNEY showed three specimens :

(1) A dermoid cyst of ovarian origin that had been expelled through the rectum during labour;

(2) A specimen removed by operation consisting of the uterus, vagina and urethra, showing a squamus-cell carinoma of the cervix co-existent with an adeno-carcinoma of the body of the uterus. A metastatic squamous-celled growth round the urethra was also present.

(3) A hernia of the umbilical cord containing a large proportion of intestine which had been unwittingly been removed by a practitioner when separating the child at birth. The umbilicus was opened and the cut ends of the gut were united. The child died 12 hours later, and a *post-mortem* examination showed that practically all the intestine had been removed, the beginning of the jejunum having been joined to the rectum.

Remarks were made by Dr. EDEN, Dr. WILLIAMSON, Dr. BLACKER, Dr. BRAXTON HICKS, Dr. MAXWELL.

Dr. VICTOR BONNEY replied.

Dr. DRUMMOND MAXWELL showed a specimen of

(1) Fibroid uterus removed after the third stage of labour. The specimen, from Queen Charlotte's Hospital, shows a large interstitial fibromyoma, 6 in. in diameter in the fundus of the uterus, removed by hysterectomy after the third stage of labour. It did not complicate delivery, which was spontaneous. Before delivery the uterus was found to be much larger than normal, and twins were suspected. Free bleeding ensued after the placenta was expelled, and on the hand being introduced into the uterus a large mass was felt bulging into its cavity. The patient was æt. 23. Owing to the severe hæmorrhage the uterus was removed by the abdominal route; myomectomy was not considered advisable. On opening the uterus after hardening, it was found that the placental site occupied part of the capsule of the fibroid, and that it would have been impossible to enucleate the mass without severe mutilation of the uterus. Risks of sepsis were discussed in any expectant treatment, if the tumour had been left *in situ*.

(2) Defective ossification of an infant's head. This case exhibited cranial dysostosis, the malformation of the vault of the head being considerable, a large gap existing between the two halves of the frontal bone measuring $3\frac{1}{2}$ by $2\frac{1}{2}$ in., covered only by tough pericranium. The clavicles were normal. The mother's pelvis showed some contraction, and forceps extraction was necessary. On delivery the head showed an inverted gap anteriorly, and it was thought the child had a depressed fracture. There was exophthalmos and a typical cry. Four hours after, the scalp was reflected over the supposed fracture, but only revealed the defective area of ossification described. The child died 3 hours after.

Dr. HERBERT WILLIAMSON and Dr. CHARLES NOON (St. Bartholomew's) read a communication on

A CASE OF CHORION EPITHELIOMA PRESENTING SOME UNUSUAL FEATURES.

The specimen was removed from a woman, æt. 39, the mother of two children. After the birth of her last child she was regular for four years. In February, 1912, after three months' amenorrhœa, she passed a vesicular mole. She remained well after this up to the end of March, 1912, when she became ill with fever and pain, and an abscess was opened per vaginam. After this she was better up to July, when she was attacked with abdominal pain and vomiting, and she began to lose weight. In August there were chest symptoms and slight hæmoptysis. On admission to St. Bartholomew's Hospital on August 4th she was very ill, and there were signs in the left side of the chest. Respirations 40, pulse 108. The skin was jaundiced. There was a large mass in the abdomen extending for a distance of 7 inches above the top of the symphysis. Per vaginam the cervix was difficult to reach, and a tender, fixed mass occupied the greater part of the pelvic excavation. The diagnosis of pregnancy versus new growth was one of difficulty. X-ray skiagrams, however, showed dark areas in both lungs, and secondary growth was

suspected in the liver. Abherhalden's test was performed by Mr. Mackenzie Wallis, with a strongly positive result with ninhydrin and the optical method. A diagnosis was therefore made of chorion epithelioma. The patient gradually sank and died on the 20th day after admission. Dr. Williamson showed the mass of growth which occupied the pelvis, and it was remarkable that the uterus itself was little affected, the main portion of the growth being behind the uterus, filling the pelvic cavity and measuring 7 in. by 4 in. It was intimately connected with most of the pelvic viscera, and its lower pole on section exhibited the usual dark-red colour. The liver and lungs contained secondary growths. Sections of the growth and secondary deposits showed typical chorion epithelioma. It was pointed out that Abderhalden's test was of great value in such cases in order that an early diagnosis could be made, and that mere exploration of the uterine cavity was worthless, seeing that in the case reported the growth was completely outside the uterine cavity. It was also interesting to note that 16 months elapsed between the expulsion of the mole and the onset of the symptoms.

Remarks were made on the case by the PRESIDENT, Mr. VICTOR BONNEY, Dr. GORDON LUKER, Dr. ARCHIBALD LEITCH.

Dr. J. M. BARRIS read a communication on

THE TREATMENT OF PREGNANCY COMPLICATED BY MORBIS CORDIS BY MEANS OF CÆSAREAN SECTION UNDER SPINAL ANÆSTHESIA.

Dr. Barris reported a successful case of this sort from the maternity department of St. Bartholomew's Hospital, and read notes of four other cases which he had collected. The author's case was a multipara, who had had ten previous labours, the last in April, 1910. She had rheumatic fever in 1901, and in 1910, just before the birth of her last child. At this time there was no sign of cardiac failure, but she had suffered with shortness of breath since. On admission to Mary Ward, under Dr. Herringham, she was very ill with a dilated heart, dyspnœa, and an almost uncountable pulse. The case improved somewhat by venesection and digitalis, and was transferred to the maternity ward. She was then about 27 weeks pregnant. A relapse occurred, and Dr. Barris decided on operation under spinal anæsthesia for the following reasons: (1) to practice rapid delivery some form of anæsthesia was necessary; (2) a general anæsthesia was contra-indicated owing to the condition of the heart; (3) abdominal Cæsarean section was preferred to the vaginal on account of the size of the child, and that the patient could be sterilised. The operation was quite successful and the patient made a good recovery. Other cases of this nature were quoted by the author, viz., those of Watts, Fairbairn and Stabb, and a reference to a case reported by Kreiss.

Remarks were made by Dr. MAXWELL, Dr. BLACKER and Dr. FAIRBAIRN; and Dr. BARRIS replied.

Dr. T. WATTS EDEN read a paper on

A CASE OF SUPERIOR RECTO-VAGINAL FISTULA DEALT WITH BY AN ABDOMINAL OPERATION AFTER PRELIMINARY COLOSTOMY, WITH REMARKS ON THE OPERATIVE TREATMENT OF THIS CONDITION.

The patient was a 6-para, æt. 38, who was admitted to the Chelsea Hospital for Women with a large recto-vaginal fistula, on July 29th, 1913, about five weeks after the birth of her last child. At the fifth confinement a serious laceration of the posterior wall of the cervix and the posterior vaginal fornix had occurred. The injury resulting in the formation of the fistula appeared to have been caused by the scar tissue resulting from

this injury bursting during the process of dilatation at the subsequent confinement. The fistula was very large, admitting two fingers, and was situated at the highest part of the posterior vaginal wall. The parts were immobile, and the cervix could not be drawn down by traction. After considering the various alternatives, it was decided to attack the fistula from above by a transperitoneal operation. Colostomy was first performed by Wallis's method, a loop of the pelvic colon being made use of. The spur proved quite efficient, and there was no difficulty in keeping the lower segment of the bowel clear. Three weeks later the fistula was closed per abdomen. The operation consisted in stripping the uterus and posterior vaginal wall from the rectrum down to a level of an inch below the fistula. The rectal aperture was then closed in a transverse plane with interrupted stitches taking up all the coats. There was not room for a second row of rectal stitches, so a flap of the posterior vaginal wall was stitched to the rectum so as to completely cover over the line of stitches. The uterus was removed, partly to prevent further pregnancy, partly to allow more room for working in the pelvis. The ovaries were both healthy, and therefore were not removed, and the vagina was left open for drainage. The rectal wound did not heal by primary intention, and after a week a foul vaginal discharge occurred with moderate pyrexia. These unfavourable symptoms soon subsided, and 18 days after the operation the lower segment of the bowel was irrigated from above and found to be watertight. Four weeks after closing the fistula, the continuity of the pelvic colon was restored by excising the colostomy, opening and re-uniting the gut by end-to-end anastomosis. From this the patient made a good recovery, and her condition when seen three months after closure of the fistula was quite satisfactory. The author believed that without the preliminary colostomy the operation he performed would have been a failure. He claimed for colostomy certain definite advantages in dealing with bowel fistulæ high up in the vagina—(1) it permitted preparation of the operation area to be carried out; (2) it ensured that the portion of bowel repaired could be kept absolutely at rest during healing; (3) it prevented re-infection of the operation area from the fæcal stream. The steps of the operation performed were illustrated with the epidiascope, and other methods than the abdominal route of dealing with recto-vaginal fistula were referred to.

Remarks were made by the PRESIDENT and Dr. GILES.

MIDLAND OBSTETRICAL AND GYNÆCOLOGICAL SOCIETY.

Meeting held in Bristol, Tuesday, January 6th, 1914.

The President, Dr. WALTER SWAYNE (Bristol) in the Chair.

Dr. R. S. STATHAM read notes on the following cases under the care of Dr. Swayne, and showed the respective specimens:

1. THROMBOSIS OF THE SUPERIOR MESENTERIC ARTERY.
2. SEPTIC UTERUS REMOVED BY HYSTERECTOMY.
3. FIBROMYOMA PRODUCING RETROVERSION OF THE GRAVID UTERUS AND CAUSING RETENTION OF THE URINE.
4. POST-ANAL TERATOMA WHICH PRODUCED DYSTOCIA.

The cases were discussed by the PRESIDENT, Dr. W. H. NEWNHAM (Bristol), Dr. MALINS (Birmingham), Dr. PURSLOW (Birmingham), Dr. EWEN MCLEAN (Birmingham), and Mr. FURNEAUX JORDAN (Birmingham).

Mr. FURNEAUX JORDAN (Birmingham) showed a specimen of

Soft Fibroma of the Vulva

and discussed the tumour and treatment.

The case was discussed by Dr. Ewen McLean.

Dr. Newnham read a short communication upon

Three Cases of Pyosalpinx treated without Drainage.

A discussion upon the question of drainage in the treatment of pyosalpinx followed, in which Dr. Purslow, Dr. Tenison Collins, Mr. Furneaux Jordan and Dr. Ewen McLean took part.

Dr. D. C. Rayner read a communication upon a case of

Pyosalpinx complicating Pregnancy.

The case was discussed by the President.

Meeting held in Birmingham, Tuesday, March 3rd, 1914.

The Vice-President, Mr. Christopher Martin (Birmingham) in the Chair.

Dr. Purslow (Birmingham) showed a specimen of

Pyometra due to Intra-Cervical Cancer.

The specimen was removed from a multipara 59 years of age, who complained of irregular hæmorrhage of 15 months' duration following several years amenorrhœa. There had also been difficulty in micturition. On examination, a symmetrical tumour was found reaching above the pubes and filling the pouch of Douglas. This was diagnosed as an enlarged and retroflexed uterus. The cervix was situated high up behind the pubes and only the posterior lip could be reached by the finger. This was normal. A degenerated fibroid was suspected and it was not until the abdomen was opened that the exact nature of the disease was recognised. Panhysterectomy was performed and the patient made a good recovery. The unusual features of the case were the large size of the pyometra, the uterus containing two pints of foul-smelling pus, and the fact that the cervical carcinoma could not be felt on digital examination per vaginam.

Dr. Edge (Birmingham) suggested that if a diagnosis of pyometra is made before operation, it might be advisable to wash out the uterine cavity previous to laparotomy.

Dr. Thomas Wilson (Birmingham) did not think that the pus in pyometra was of a very infective character although it might possess a foul odour. The usual cause of pyometra was cervical cancer, and he personally had seen from 8 to 10 examples. He recognised two forms of the condition. In one, the pus was due to the retention and decomposition of uterine secretion and tissue above a cervical growth. The other was the result of an active destruction of the uterine wall by the corporeal neoplasm. In this latter type of case, there was frequently present a considerable degree of surrounding induration.

Dr. Kirkby Thomas (Birmingham) referred to the very large size of the pyometra in Dr. Purslow's case and the very offensive nature of the contained pus.

Mr. Beckwith Whitehouse (Birmingham) asked if Dr. Purslow had seen pyometra apart from cancer. In a paper communicated to the Obstetrical and Gynæcological Section of the Royal Society of Medicine, he had drawn attention to the fact that some cases of pyometra appeared to be the result of syphilis. He personally had seen two cases of well-marked pyometra combined with undoubted constitutional syphilis, and Dr. Thomas Wilson had kindly furnished him with details of two other cases in which the presumptive evidence of a syphilitic factor was great.

Mr. Christopher Martin (Birmingham) emphasised the value of

vaginal clamps in operations for pyometra in preventing contamination of the surrounding tissues.

Mr. Furneaux Jordan (Birmingham) showed a specimen of

Double Ovarian Cystic Tumour of Intra-ligamentary Development,

which will be reported in full in the Journal.

Dr. Thomas Wilson (Birmingham) referred to the interesting fact of the absence of ascites in the presence of such extensive papillary growth. He also thought that the tumours were of extremely large size to be of intra-ligamentary development, and suggested that the appearance was the result of inflammatory adhesions.

Dr. Edge (Birmingham) asked for further information as to the method of down-growth of the cysts into the cellular tissue of the broad ligaments.

Dr. Bursiow (Birmingham) referred to the same matter.

Mr. Christopher Martin (Birmingham) thought that the absence of ascites was accounted for by the fact that the tumours were buried in the broad ligaments and therefore did not communicate with the peritoneal cavity. He thought that the tumours were undoubtedly malignant and that a recurrence will occur in the broad ligaments.

Mr. Furneaux Jordan (Birmingham), in reply, observed that at a later meeting he would report the subsequent history of the case. The excellent health of the patient appeared clinically to negative the question of malignancy.

Dr. Thomas Wilson (Birmingham) showed a specimen of

Diffuse Ovarian Suppuration with Tubo-Peritoneal Cyst

which will be reported in detail in the Journal.

Mr. Christopher Martin (Birmingham) asked what was the nature of the micro-organism and the cause of the infection in this case. He also commented upon the use of the transverse abdominal incision that Dr. Wilson had employed. Personally he thought that in such a case the "flap" would favour the occurrence of septic trouble.

Mr. Furneaux Jordan (Birmingham) enquired as to the situation of the ovary in the cyst wall. He also enquired whether the patient had complained of any attacks of pain within the last 10 years, since Dr. Wilson attributed the lesion to the results of a pregnancy so long previous to the present illness.

Dr. Pursiow (Birmingham) quoted details of a case of acute salpingitis associated with localised serous peritonitis. In this instance the uterus and intestines were covered with large numbers of small serous false cysts containing serous fluid.

Mr. Pardhy (Birmingham) referred to the occurrence of similar inflammatory cysts in relation with appendicitis. Recently he had operated upon a patient whose condition had been diagnosed as "ovarian cyst." At operation, however, the tumour was found to be a large inflammatory peritonitic cyst. The wall was lined with endothelium. There was no evidence to think that it was tubercular, and in this instance the abdomen was closed without any cause being assigned as to its origin.

Dr. Edge (Birmingham) showed a specimen of

Carcinoma of the Ovary with Metastasis at Base of the Appendix Vermiformis.

Mr. Beckwith Whitehouse (Birmingham) thought that this specimen raised very important points in connection with the lymphatic distribution between the appendix and the right uterine appendages. A ligament had been described as existing between these structures. Dr. McNaughton

Jones had referred to the subject at length in his Presidential Address to the Obstetrical and Gynæcological Section of the Royal Society of Medicine, and Mr. Whitehouse thought that this specimen formed a very important link in the chain of evidence to prove a direct lymphatic connection between the appendix and the meso-salpinx. He asked Dr. Edge if sections had been prepared to show whether permeation was present.

Dr. Edge (Birmingham) did not agree with Mr. Whitehouse's suggestion that the metastasis was the result of lymphatic permeation in peritonitis folds. The tip of the appendix was adherent to the diseased ovary, and he thought that it was a question of direct extension. The specimen was referred to a Pathological Sub-Committee consisting of Mr. Beckwith Whitehouse, Dr. Edge, and Dr. Smallwood Savage.

Dr. Thomas Wilson (Birmingham) read a short communication upon Concealed Accidental Hæmorrhage—Cæsarean Section—Recovery.

This case will be reported elsewhere in detail. The specimen, consisting of the uterus removed by Cæsarean hysterectomy, was of particular interest inasmuch as it showed extensive sub-peritoneal and intra-muscular hæmorrhages. These were most evident at the uterine cornu. Microscopical preparations showed extreme degeneration of the myomatous elements in the uterine wall. The degeneration appeared to be hyaline, but its exact nature was so far undetermined. The case was of considerable interest because it raised several new points in the pathology and causation of the hæmorrhage in this condition.

Mr. Christopher Martin (Birmingham) congratulated Dr. Wilson upon the success that had attended his treatment of the case. Personally he remembered details of two serious cases of concealed accidental hæmorrhage. Both patients unfortunately had died, and it was certainly possible that they might have been saved if similar measures had been employed to those used in Dr. Wilson's case.

Mr. Furneaux Jordan (Birmingham) referred to the very grave prognosis in all cases of concealed accidental hæmorrhage. Personally he had never seen a case recover.

Mr. Beckwith Whitehouse (Birmingham) thought that a very interesting and important point had been raised in the question of sub-peritoneal hæmorrhages, and referred to a case published by Dr. Shannon of Glasgow (British Medical Association, 1912), in which superficial ruptures of both uterine muscle and peritoneum were present. The relation of these hæmorrhages to degeneration of the uterine musculature certainly appeared to point to some toxin as the underlying cause. It was impossible at present to say whether the toxin was elaborated by the maternal or fœtal organism.

Dr. Smallwood Savage (Birmingham), in congratulating Dr. Wilson upon the success obtained in his case, referred to the discouraging results usually attending all forms of treatment in this condition. He recognised three classes of these cases :—

a. Those who get well after vaginal packing.
b. Those who recover after operation.
c. Those who die in spite of any treatment.

Dr. Edge (Birmingham) did not consider that Dr. Wilson's case was an example of concealed accidental hæmorrhage in the true sense of the word. He would prefer to classify it under the heading of " Toxic Uterus containing Blood." If, on the other hand, it was a case of concealed accidental hæmorrhage, it was very remarkable, and it upset all his preconceived

views regarding the relationship of tonic uterine contraction and hæmorrhage.

Dr. W. H. NEWNHAM (Bristol) thought that the treatment employed in Dr. Wilson's case had been absolutely correct, and quoted details of cases that had come under his notice in which much more conservative methods had terminated fatally.

Dr. EDGE (Birmingham) read a short communication upon a case of

INVERSION OF THE UTERUS.

The patient, aged 28, a three-para, was admitted to the Women's Hospital, Birmingham, August 17th, 1913. Five days previously she had given birth to her fourth child and had been attended by a midwife. No exact details were obtainable as to what transpired, but she was sent into hospital as a case of puerperal fever following post-partum hæmorrhage. On admission the woman was acutely ill with a pulse of 160 and temperature 104 °F. Preparations were made for obtaining a swab from the uterine cavity, but upon vaginal examination a rounded mass was felt within the vagina. Bi-manually the uterus was found to be absent and a diagnosis was made of "Uterine Inversion." It seemed hopeless to perform any abdominal or vaginal section. Nevertheless, by dilatation of the cervix from above and reduction of the parts last inverted, the condition was gradually reduced. The uterine cavity was cleansed with hydrogen peroxide and packed with iodoform gauze. The following day the patient's temperature was 105 and pulse 150. She was treated with polyvalent anti-streptococcic serum, and eventually made a perfect recovery.

Mr. CHRISTOPHER MARTIN (Birmingham) said that the excellent results obtained in this case showed the advantages of skilled hospital treatment in these grave puerperal complications. If the woman had been treated at her own home, she would most certainly have died. The case also showed the importance of a routine examination of all puerperal cases. He had found Tait's repositor of use in replacing some cases of inverted uteri.

Mr. FURNEAUX JORDAN (Birmingham) emphasised the importance of re-examination at the time of replacement, inasmuch as inversion may be complicated by fibroid. In the treatment of chronic inversion, he advocated the employment of an anterior cervical incision. After displacement of the bladder, the peritoneum was opened and adhesions could then be separated. In his last case he had found it necessary to split the uterus as far as the fundus. The anterior incision appeared to give more room and replacement was easier than when the posterior method was employed.

Dr. PURSLOW (Birmingham) thought that the most important symptom of uterine inversion was hæmorrhage. If this was present, the indication for immediate reduction of the displacement was not urgent. He did not think that sepsis was improved by replacement of the uterus.

Dr. THOMAS WILSON (Birmingham) observed that Dr. Edge's case was an example of acute inversion complicated by most severe sepsis, and he congratulated him upon the successful issue he had obtained. If hysterectomy had been performed, the patient would undoubtedly have died. It was curious how easy the reduction appears to have been after the interval of six days. He would have thought that the uterine tissues would be hard and board-like after this period and replacement by no means easy.

ROYAL ACADEMY OF MEDICINE IN IRELAND.

SECTION OF OBSTETRICS.

President—M. J. Gibson, M.D.
Sectional Secretary—Gibbon FitzGibbon, M.D.
Friday, March 6, 1914.
The President in the Chair.

Exhibits.

Fibro-Myoma presenting unusual features.

Dr. Alfred Smith said this specimen was specially interesting to those who operate. The patient consulted him for painful tumour in the lower abdomen, and on examination it was recognised to be a fibro-myoma. The patient was aged 35, and complained chiefly of the painful tumour. On opening the abdomen difficulty was experienced owing to adhesions between the tumour and the abdominal walls, and it was necessary to open higher up. It was then found that there was a coil of small intestine attached to the top of the tumour. Peculiar peritoneal folds were found hanging from the tumour simulating intestine. He was not in a position to determine how these folds were formed in this type of tumour.

(1) Combined Intra- and Extra-Uterine Pregnancy.

The President said the patient J. B., aged 36, married fourteen years, had seven children and two abortions. The youngest child three years. She aborted at the fourth month in September, 1912, and again at the sixth month in August, 1913. She had been seen on the 26th of November, 1913, when she stated that she had not menstruated since 17th September, 1913. She complained of pain in her right side low in the abdomen, and extending to her back. This pain had begun about ten days previously, and had not been severe. There was no bleeding. Examination revealed an enlarged, softened uterus, acutely anteflexed. At the right side of it a tumour was to be felt, about the size of a small hen's egg, and very tender. It was not pulsatile. There was no resistance in Douglas's pouch, and the tumour was mobile. After examination I told the patient that she should come into hospital, so that this small tumour could be kept under observation. The patient came into hospital three days afterwards. She said she had had some pain in the interval, which had been very severe. Examination then showed some resistance in Douglas's pouch, and the patient continued to complain of periodic attacks of acute pelvic pain. I diagnosed a tubal pregnancy complicating an intra-uterine pregnancy, as I had never yet felt any softening of the uterus sufficient to make it feel cystic or any marked enlargement of the uterus in cases of tubal pregnancy. I opened her abdomen, and found some free blood in the pelvis with clotted blood in Douglas's pouch, an enlarged tube and a pregnant uterus. I removed the tube, and the patient made an uninterrupted recovery for two weeks, when she expelled the other ovum from her uterus. The patient was able to leave the hospital ten days later. Whether the tubal pregnancy was due to the second ovum becoming impregnated after the first, and consequently finding its passage to the uterus impeded by the decidual reaction in the tube, is an interesting question.

(2) Early Tubal Pregnancy.

The patient, aged 25, had one child three and a half years previously. Her periods had been regular in time, and as usual in quantity and

duration up to six weeks before I saw her; since then she had not menstruated, nor had she any discharge until twenty-six hours before she came into hospital. She was then seized with violent abdominal pains, and a very slight red discharge made its appearance about an hour after she had been examined by her doctor. The pain continued in spite of poulticing, &c., and she finally took her doctor's advice and allowed herself to be removed to hospital. When she came in she presented all the appearance of severe blood loss. She was blanched, restless, and her pulse was 120. Her abdomen was tender to touch, somewhat rigid over her pelvis, and examination under an anæsthetic showed an apparently normal uterus, with a very small tumour at the left-hand side of it. The tumour was mobile. When the abdomen was opened a quantity of fluid blood escaped immediately. There were a number of small blood clots and the enlarged tube. The tube was removed, and the abdomen closed when the blood had been removed. The patient was very collapsed, but recovered under the usual treatment. The hæmorrhage was due to the erosion of the tube, and escaped from a small opening.

(3) Unruptured Interstitial Tubal Pregnancy.

The patient, M. H., aged 28, married four years, and had two children, the youngest thirteen months old. Her menstruation had been regular in time, quantity, and duration since her baby was eight months old. One month before she consulted me her period had come on two days later than usual, and smaller in quantity, but she had continued to bleed since. The discharge was as a rule scanty, but on three occasions it had been rather profuse. She also complained of some pain at the left side of her pelvis and in her back. She did not believe that she was pregnant. Examination revealed what at first appeared to be a pregnant uterus at about the sixth week with a myoma in its left side. The ovaries were palpable, and apparently normal. Closer examination of the hard portion of the enlarged uterus showed that it resembled the greater portion of a non-pregnant uterus, in the left side of which a cystic tumour had developed. Under an anæsthetic the uterus was apparently in every way normal but for this cystic tumour in its right side, and I concluded it was an unruptured interstitial tubal pregnancy. There was no resistance in Douglas's pouch. When the abdomen was opened I found the first portion of the round ligament stretched out over the cystic enlargement, and the isthmial portion of the tube appeared normal. There was no free blood in the pelvis. An incision was made over the right side of the uterus, and a normal ovum was turned out from an extremely thin capsule, consisting mainly of peritoneum. The capsule of the ovum was stitched up and the hæmorrhage, which during the operation had been profuse, was thus controlled. The patient made an uninterrupted recovery.

Dr. Tweedy said he would like to know what was done with the tube in the case of interstitial pregnancy. He presumed the tube was broken in order to clear out the ovum. He had seen interstitial pregnancy, but never saw a case of combined uterine and tubal pregnancy.

The President, replying to the remarks, said that as regards the unruptured interstitial pregnancy he did not interfere with the tube at all; the incision was made low down, and the ovum turned out of its capsule. He did not believe that he closed the interstitial portion of the tube when suturing the capsule. As regards the combined intra- and extra-uterine pregnancy, there was no doubt whatever about the tubal pregnancy, as the microscopical examination proved the presence of a

recent ovum. He believed that the formation of the decidua in the tube was the most likely cause of the tubal pregnancy.

A Note on Malaria as a Complication of the Puerperium.

Dr. Bethell A. Solomons read "A Note on Malaria as a Complication of the Puerperium," in which he commented on the scarcity of cases to be found in the literature. The chief case which had come under his notice was that of an Indian official's wife with a history of an attack of malaria two years previously. The confinement was complicated, and there was an extensive laceration of the perineum and vagina. The diagnosis between sepsis and malaria was extremely difficult. The absence of growth after lochia and blood had been cultured and the presence of the plasmodium malariæ in the blood clinched the diagnosis. She recovered after a stormy puerperium.

Dr. Hastings Tweedy said he had seen two or three cases of malaria in his practice, and he also saw one of Dr. Solomons' cases, in which he suggested malaria as a possible cause of the temperature. He emphasised the importance of taking uterine cultures early. With a temperature like that seen in Dr. Solomons' case, if the culture is negative no time should be wasted in getting a specimen of the blood, and he advised that a good quantity of blood should be taken. He was convinced that the first case was not one of pure malaria, but that some septic infection was associated with it.

Dr. Stevenson, R.A.M.C., inquired what was the nature of the parasite found, as in his experience when quinine is administered in such cases the temperature should settle down in four days, and it was noted that it did not do so for six days in the cases reported.

Dr. M'Allister inquired if there was any information forthcoming to show if a child born under such conditions, if exposed to the infection of malaria, would be immune, and as to whether the malarial parasite could traverse the placenta and so reach the fœtal circulation.

The President inquired if the child had an enlarged spleen, or if any pigmentation was noticed. He considered that people who had had malaria were predisposed to it after operation or childbirth.

Dr. Solomons, in reply, said that his reason for bringing forward the subject was that the condition was apparently so rare.

With reference to Dr. Tweedy's suggestion that the malaria was not the only cause of the temperature he (Dr. Solomons) considered that the vaginal condition possibly aided in keeping up the temperature for a longer period than in an ordinary case of malaria.

Dr. Rowlette had examined the blood, but the variety of parasite was not stated.

It would be interesting to know if the child was immune. He had not considered the point. The baby was a particularly fine specimen with no abnormality. The mother had been healthy during the whole pregnancy.

Pituitrin in Labour.

Drs. Madill and Allan read a paper on the use of pituitary extract in labour, in which they reported the results of 147 cases. Referring to its effect on the uterus, they found that the contractions resulting from the drug retained their physiological character, and they regarded this as the fundamental principle governing its use in labour cases. They had never observed a tonic contraction. The interval between pains was diminished by one half, and the effect of the drug lasted fifty minutes. There was an earlier detachment of the placenta. Regarding the effect on the fœtus, they often noticed a drop in the fœtal heart following the injection, but

the child was born healthy. They reported in detail four cases of fœtal death which might be due to the injection of the drug. It was tried unaided in one case to induce premature labour, and in two cases in conjunction with Champetier de Ribes' bag, all being successful. They considered the second stage, with the head well through the brim, as the best time for its administration, and in most of their cases the drug was given at this time. They had good results with it in *post-partum* hæmorrhage in combination with ergot. Its use was contraindicated in heart lesions, but probably not in nephritis. It was a valuable adjunct in cases of placenta prævia where version had been performed. They had six instances of *post-partum* atony of the uterus of a slight degree.

Professor SMITH said he had no experience of pituitrin in midwifery. His only experience of it was in gynæcology, and it was of interest to know that it does equally good work in that branch. He was at present using it in cases of infantile uterus and the menorrhagia of young girls. He mentioned that it was noticed that young rats who were fed on pituitrin extract grew to a great size, and that their genital organs were hypertrophied, and it was for this reason that he was using it. He also mentioned its utility in connection with intestinal stasis after laparotomy. It was known that pituitary extract had an action on the mammary gland, and he would like to know if any observations had been made of the mammary secretion in these cases.

Dr. SHEILL said he was interested in the subject, as he had experience of the drug in about twenty-six or twenty-seven cases. He had always given it intramuscularly, and his experience was that it took eight and a half minutes to act. He would like to know if the difference between the three and a half minutes experienced by the writers of the paper and his eight and a half minutes was accounted for by the difference in the site of injection.

Regarding anæsthetics having no marked result on the injection, he asked if the drug had been used in cases in which scopolamorphine had been given, as he considered the drug less effective after scopolamorphine than in other cases. He understood from the paper that if the drug was used an hour or more before the birth of the child there was an inclination to atonic *post-partum* hæmorrhage, and if this were so he asked why it is to be recommended to use the preparation in *post-partum* as a routine, because if the action is intermittent, and the action of ergot is continuous, was it not more desirable to continue the use of ergot *post-partum*? He would like to know what was thought of the use of pituitary extract in cases of eclampsia.

Dr. TWEEDY said he noted that Dr. Madill and Dr. Allen thought many forceps cases had been saved by the giving of pituitrin. He suggested that it would be more instructive if the number of forceps cases were compared for a period when pituitrin was given with a similar period when it was not administered.

He recommended the use of pituitrin in cases where curetting failed to stop hæmorrhage, and would suggest its use before resorting to larger operations. He was glad that the writers disapproved of its employment in cases of contracted pelvis. He mentioned a case of rupture of the uterus, following quickly upon the administration of pituitary extract, brought under his notice by a doctor in America, and drew attention to the fact that no mention was made in the paper of deaths which occurred from the giving of this drug. He inquired if the Assistant Masters ever tried a smaller dose than 1 c.c. He had found half of the contents of one

of these small phials sometimes produced extremely good labour contractions, and he always injected half the quantity, and then proceeded to give the remainder if it was not effective. He pointed out that Dr. Jardine spoke at the Congress in London in glowing terms of the use of the drug in cases of accidental hæmorrhage. He inquired if failures occurred in any cases in which injections were given, or was it practically uniformly successful in exciting strong labour pains. He did not consider that cases delivered by forceps in the Rotunda Hospital could be compared with the cases where pituitary extract was given.

Dr. SOLOMONS said it seemed to him a most fortunate matter that most authorities agreed that whilst the drug was useful in cases of active abortion it was useless as an abortifacient. He wished to know how the syringe was sterilised, as successful results seemed to depend partly on this. He was surprised to hear that there were no lacerated cervices or ruptured uteri in any of the cases, as De Lee, in the Year-Book of Obstetrics, published by the Chicago Year-Book Publishers, commented on these results of the drug. It was of the utmost importance, where there was a suspicion of contracted pelvis, that pelvimetry should be done before administering pituitrin. In cases of *post-partum* hæmorrhage he would like to know whether any preparation of ergot was given as well: he had found ergotin citrate most satisfactory. He asked if the drug had been used in cases of atony of the bladder. He mentioned that he had given pituitary extract with excellent effect in cases of amenorrhœa with chlorosis.

Dr. M'ALLISTER referred to a paper read by him regarding the control of *post-partum* hæmorrhage and shock from that condition by intravenous injections of a very dilute solution of infundibulin. He said undoubtedy these preparations increase the uterine contractions, but he did not consider that the contractions preserved their physiological character, there being a tendency for the interval between the pains to become too short. He considered the drug at its best where there was slight obstruction, and he pointed out that the general opinion was that it was most useful and safest for the child during the expulsion stage. He did not feel satisfied that the results obtained from pituitrin in the third stage were as satisfactory as from ergotin. He had found that the injection of pituitrin into the uterus was very useful preceding Cæsarean section. Pituitrin markedly increased the excretion of urine. In cases of retention of urine after operation his experience in the Coombe Hospital showed that it was useless.

Dr. JELLETT thanked the writers for the amount of work they had performed and for the valuable results brought forward. He had little doubt that if anyone was to study the paper and deduce facts from it he would be able to get some valuable information. He pointed out that it had been found that the use of pituitary extract in 140 cases had not been followed by any bad results. As to the question of fœtal mortality, he had been sceptical about its use for some time, because he thought perhaps it was followed by definite danger to the fœtus. However, he considered the results brought forward were strikingly directed to prove the contrary. Although he agreed with Dr. Tweedy in regard to the application of forceps, still the fact remained that in a large number of cases in which forceps are applied the necessity for their application arises out of a delay in the second stage, and if pituitary extract avoids this there should be a lower morbidity. He considered that the use of pituitary extract was contraindicated where there was any obstruction to the birth of the child,

but where there is no undue obstruction and where rapid pains can empty the uterus he thought Drs. Madill and Allan had shown that the drug was useful. With regard to the use of pituitary extract in *ante-partum* hæmorrhage he would like to emphasise the fact that delay after the hæmorrhage was checked was beneficial to the patient, although it was anything but beneficial to the child. He thought, therefore, that it was unwise to hasten delivery until the woman had recovered somewhat, and that then pituitary extract might be of value when uterine contractions did not come on strongly of themselves.

The PRESIDENT said he had seen two cases in which its administration during the first stage had been followed by extensive laceration of the lower uterine segment. In a case of placenta prævia it was impossible to turn the child owing to the effect of the extract. He considered the extract contraindicated in the first stage of labour unless the contractions were very feeble and the stage prolonged, and the cervix neither diseased nor friable. In the second stage it was excellent when there is uterine inertia; after the third stage it should be combined with intra-muscular injection of ergot.

In conclusion he pointed out that he had seen much trouble result from the injudicious use of the extract, and that it should not be used freely but with great care, and not at all in cases of obstruction.

Dr. ALLAN, in replying to the remarks, said there was no change noticed in the mammary gland. In the first cases the drug was given intra-muscularly, but latterly sub-cutaneously. It was found that when it was given by the former method the pains came on quicker, but by the latter method the pains were more gradual and at longer intervals. They had no experience of it with scopolamine morphine. The drug was never given in *post-partum* hæmorrhage alone, it was always combined with ergot; neither had it been administered in cases of eclampsia. In five cases the drug had failed to be of any use. In the year previous to the use of the drug there were 106 forceps cases at the Rotunda Hospital, and during the past year when it was given there were only 56 cases. No opportunity was afforded of trying the drug in a case of accidental hæmorrhage. Syringes were sterilised by boiling, and afterwards kept in sterilised water. There was no experience in any of the cases of cervical tears. It was agreed that the best results were obtained in the expulsion period. It was not considered that the drug had any advantage over ergot in cases of Cæsarean section, and the latter was always given. They were emphatic in their opinion that the drug should be used with caution, and that the fœtal heart should be carefully watched.